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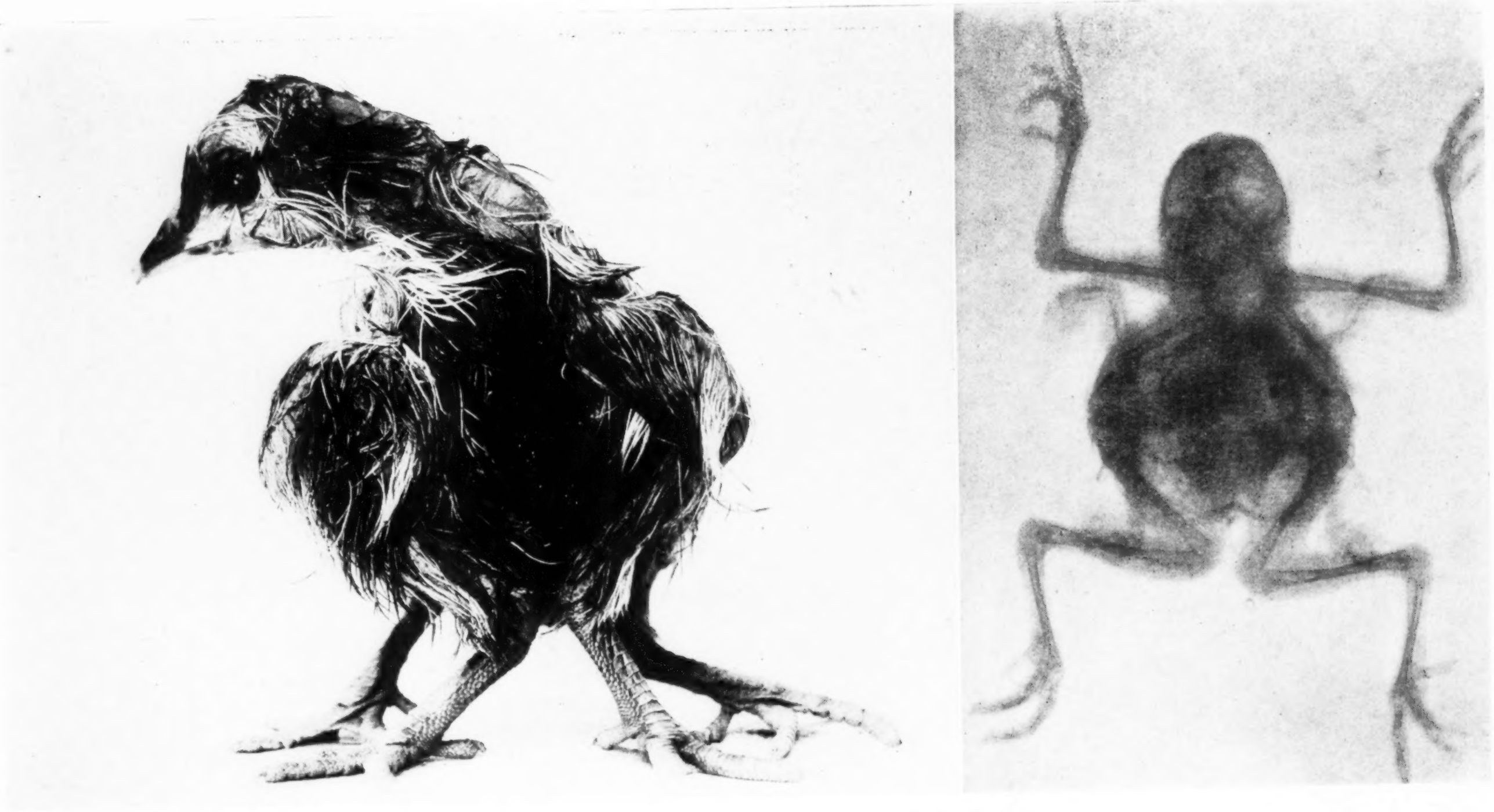


CHICK WITH FOUR LEGS AND FOUR WINGS

The Single Comb Ancona chick above photographed was sent in by A. J. Pigott of Sulphide, Ont. While this type of meristic variation is not unusual, the equal development of the limbs is noteworthy, as in many instances the extra limbs tend to be only rudimentary. One can hardly doubt that this bird was produced from a single germ-cell. The head is the first part of the embryo to be formed. At about the time the head was formed, the hinder part of the embryo must have split. Experimental work gives color to the idea that this splitting is due to some chemical change. At the time the split occurred, the cells of the posterior part were evidently not much differentiated, and each half of the rear end of the embryo, therefore, went ahead in the customary way and produced a whole chick. This well illustrates the perfection of the developmental mechanism, which will function perfectly to the end even if reduced to half the usual quantity. The photograph at the right is not a frog, as might be supposed, but the same chick viewed by X-ray. (Frontispiece.) M. A. JULL, Macdonald College, Quebec.

THE "MELTING POT" A MYTH

Study of Members of Oldest American Families Shows that the Type is Still Very Diverse—No Amalgamation Going on to Produce a Strictly American Sub-Type—Characteristics of the Old American Stock

AMERICA as "The Melting Pot" of peoples is a picture often drawn by writers who do not trouble themselves as to the precision of their figures of speech.

Dr. Ales Hrdlicka has been investigating the older contents of this pot, and finds that even the material which went into it first has not yet so melted.[1]

Several hundred members of the old, white, American stock have been most carefully measured and examined in many ways, to find whether the people making up this stock are tending to become alike—whether a new sub-type of the human race is being formed here in America, with intermarriage, environment, and under the pressure of outward circumstances.

Dr. Hrdlicka finds very definitely that as yet such is not the case. The force of heredity is too strong to be radically altered in a century or two, and even the descendants of the Pilgrim Fathers, the Virginia cavaliers, the Pennsylvania Dutch and the Huguenots, while possibly not as much unlike as their ancestors probably were, are still far from a real blend.

"The Melting Pot" is a figure of speech; and, as far as physical anthropology is concerned, it will not be anything more in this country, at least for many centuries.

Dr. Hrdlicka, who is curator of the division of physical anthropology of the United States National Museum at Washington, has had this investigation under way for four years,[2] and it has been completed only within the last month—for Americans of unbroken American ancestry for even three generations are much scarcer than was supposed when the work was undertaken. Even the proud "Mayflower Descendant" is more likely than not, it would seem, to have at least one grandfather or grandmother who was born abroad. The conclusions here announced were reached a year ago, and must be regarded as not wholly final, yet doubtless reflecting the real conditions. With this understanding, some of the more remarkable of the preliminary results, based on the first 100 men and 100 women measured, may be cited.

GREAT RANGE OF VARIATION

"The most striking result of the examinations," Dr. Hrdlicka says, "is the great range of variation among Old Americans in nearly all the important measurements. The range of variation is such that in some of the most significant determinations it equals not only the variation of any one group, but the combined variations of all the groups that enter into the composition of the Americans." This fact would be interpreted by the geneticist as an evidence of hybridity. It is clear that, at the very beginning, a number of diverse, although not widely differing, stocks must have made up the colonial population; and intermarriage and the influence of the environment have not welded these stocks into one blend, but

[1] Some of the facts in this review were got from the oral communication of Dr. Hrdlicka to the XIX International Congress of Americanists, at Washington, December 28, 1915; others were given by Dr. Hrdlicka in conversation; much is taken verbatim from an advance copy of the paper to be published in the Proceedings of the Americanists at about the time the present review appears in print.

[2] See "Study of Old Americans," by Dr. Ales Hrdlicka, JOURNAL OF HEREDITY, Vol. VI. No. 11, p. 509 .November, 1914.

have merely produced a mosaic-like mixture. This is good evidence of the permanence of inherited traits, although it must be qualified by the statement that it does not extend equally to all the features of the body, the face, hands and feet having been found less variable than, for instance, the stature or form of the head.

Turning to the detailed measurements, this review can give only the averages: those who want to know the distribution of variations must consult Dr. Hrdlicka's own account, where they are all published.

STATURE

The stature of both American men and women is high, higher than the average of any European nation except the Scotch. The individual variation is, however, enormous, amounting to 16.4% of the average in males and nearly 16% in females. For males, 174 cm. is the average, for females 162. The arm spread in males is greater than their stature, in females it is less.

WEIGHT

The average weight of the males is 154 pounds, that of the females 130. Taking into consideration the tall stature, these weights are about equal to those among Europeans. The difference between male and females is 15.6%; among larger series of Europeans it is 17%, which indicates a slightly greater tendency to stoutness (among those above 30 years of age) among the American women than among their European sisters. Less than 10% of the men but at least 17% of the women were found to be decidedly under weight; the proportion of stout individuals was nearly the same in the two sexes.

BODY

The general proportions of the body must be classed as medium, but great fluctuations are shown, particularly in the chest—a feature which shows distinctly poor development among the women, often accompanied by deficient development of the breasts and shoulders. Indeed, one of the most striking of the facts brought out is that, barring individual exceptions, the women of the old American stock appear to be below par, physically. The males are, on the whole, admirable specimens of the white race; the females are not infrequently undersized, underdeveloped, and weak in comparison with what they should be.

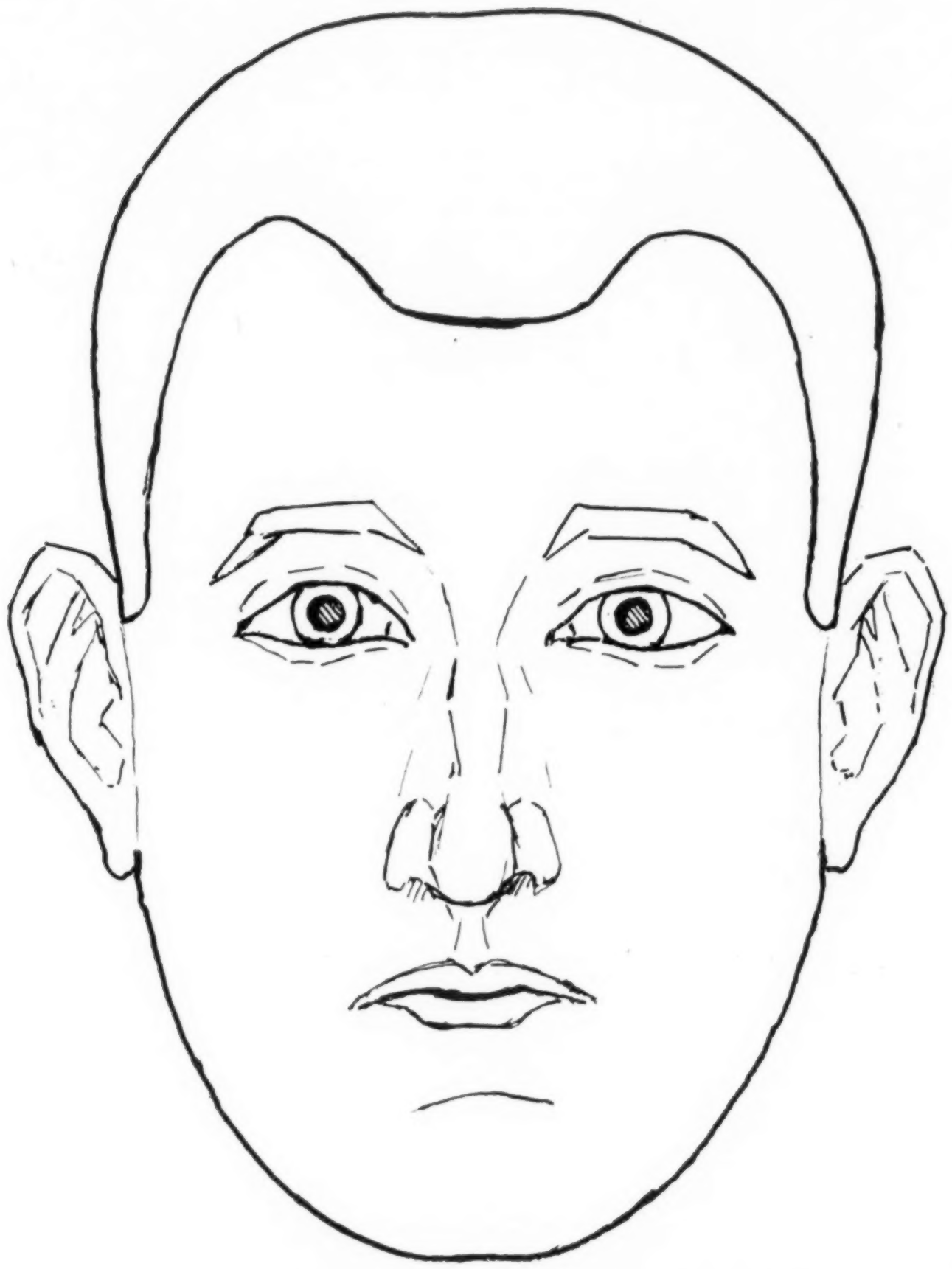
This difference is not due, the investigator thinks, to heredity, but is solely a matter of bringing-up. It is already being corrected in the younger generation, he thinks, for under the stimulus of widespread interest in sports, outdoor life and a sensible manner of living, not a few of the younger women and girls whom he has measured seem to be superior to their mothers. But he sees still room for improvement, if the women of the old American families are to be as a class such physically good types of womanhood as are the American men of manhood.

FACE

The face is, in general, high and oval; in females it occasionally gives the impression of narrowness. The forehead is well developed in both sexes, a fact which should please those persons who believe frontal development to be a sure sign of intellectual capacity. The nose is prevalently long and of medium breadth; it is longer than that in any immigrants coming to this country who have so far been measured,[3] except the English, in whom the proportions, as to both length and breadth, are practically identical with those of the Americans. The mouth shows medium breadth in both sexes, and its averages equal exactly those obtained for the French. The ears of the old Americans are longer than those of any immigrants except the English.

Comparing the present representatives of the old American stock with what is known of their ancestors, it appears that the face has retained its length but is

[3] Comprising Armenians, Croatians, English, Greeks, Russian Jews, Irish, South Italians, North Italians, Magyars, Poles, Rumanians and Russians, 500 individuals in all.



NOT THE MEANEST MAN, BUT A REALLY MEAN ONE

To anthropologists, the "mean man" of a race is an imaginary ideal, as a circle is to a geometer. Each of his features measures the mean or average of that feature in all the individuals of his race. He is in every respect an average man. The above diagram, drawn to scale from Hrdlicka's data by C. H. Popenoe, shows the mean man of the old white American stock. It is a highly specialized face which, according to ordinary ideas, is of a very superior type. The most conspicuous peculiarities of the type are the almost oblong outline of the face, and the high, well-developed forehead.

According to many anthropologists, the mean man is the standard of beauty of a people. Any feature—mouth or nose, for example—is admired in proportion as it approximates in its measurements the mean or average of that feature for the race. The face which is most admired is that which has the fewest exceptional peculiarities—which is in every respect the most mediocre, as a statistician would say. The idea of a mean man is therefore of much importance not only to students of anthropology, but to students of aesthetics. (Fig. 1.)

diminishing in breadth, and that the jaws are getting smaller.

PHYSIOLOGICAL OBSERVATIONS

The average body temperature, under the tongue and at rest, is 98.5° in the male and 98.7° in the female. Considerable variation is found, the absolutely normal limits probably being 97.5° to 99° in the male and 98° to 99.2° in the female.

The pulse averaged in males 70.6 beats per minute, in females 75.2 per minute. The normal range of variation in each sex was about 30 beats (15 below to 15 above the average).

The average rate of respiration found in males was 17.2, in females 18.5, with considerable individual variation in both sexes—males 11 to 22, females 10 to 24.

HAIR COLOR

One of the most interesting results is that there were obtained among these first 200 individuals studied no pronounced blonds, although the ancestry of these subjects is supposed to have been North European, where blondness is more or less prevalent.[4] More men than women are dark, and conversely, more women than men are light. It is a notable fact that not a single case of real red hair has been found among the males in this investigation, while 10% of the females boast some approach to Titian tresses. Also, there was not a single case of black hair, in either sex. The exact distribution is:

	Male	*Female*
Light-brown	12%	16%
Medium-brown to dark-brown	77%	68%
Very dark	11%	6%
Golden-reds and reds	00%	10%

EYE COLOR

The color of eyes in the two sexes is practically identical, blue eyes being found in about half the cases. Dr. Hrdlicka's classification is as follows:

	Male	*Female*
Gray	2%	4%
Greenish	7%	10%
Blues	54%	50%
Browns	37%	36%

HEAD FORM

The head among old Americans is, in many cases, notable for its good development, particularly in males. Among twelve groups of male immigrants measured at Ellis Island under Dr. Hrdlicka's direction in recent years, not one group quite equals in this respect the Americans, the nearest approach being noted in the Irish, Bohemians, English, Poles and North Italians. The type of head, however, differs among the Americans very widely, as is the case with most civilized races at the present day.

Head form is most conveniently described by means of the cephalic index, that is, the ratio of breadth to length. Anthropologists generally speak of anyone with an index of 75 (or where the breadth is 75% of the length) and below this, as dolichocephalic, or long-headed; from 75 to 80 is the class of the mesocephalic, intermediates; while above 80 is that of subbrachycephalic and brachycephalic or round-headed. For the most part, the old Americans fall into the intermediate class, the average index of males being 78.3 and that of females 79.5.

Barring a few French Huguenots, the old Americans considered here are mostly of British ancestry, and their head-form corresponds rather closely to that of the English of the present day. In England, as well known, the round-headed type of Central and Eastern Europe, the Alpine or Celto-Slav type, has few representatives. The population is composed principally

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[4] See for example "The Passing of the Great Race," by Madison Grant (p. 74, New York, 1916): "One often hears the statement made that native Americans of Colonial ancestry are of mixed ethnic origin. This is not true. At the time of the Revolutionary War the settlers in the thirteen colonies were not only purely Nordic, but also purely Teutonic, a very large majority being Anglo-Saxon in the most limited meaning of that term. The New England settlers in particular came from those counties of England where the blood was almost purely Saxon, Anglian, and Dane."

A TYPICAL MEMBER OF THE OLD WHITE AMERICAN STOCK

Dr. Hrdlicka declares that the above head (belonging to Rev. H. E. Robbins, a Connecticut Yankee, now in Canaseraga, N. Y.), is one of the best examples he has seen of a common type of Old White American. The cheek bones are a little more prominent than usual; otherwise the features are almost average. In proportion of breadth to length the skull is neither long nor round, but intermediate; the forehead is high, nose and ears somewhat large, and jaw reduced. It is a highly specialized type, the large size of the skull in proportion to the size of the face indicating an advanced degree of evolution. But it can be matched by many English heads, for the Old White Americans are a somewhat heterogeneous stock, not racially distinct. (Fig. 2.)

of long-headed peoples, deriving from the two great European stocks, the Nordic and the Mediterranean. To the latter the frequency of dark hair and brown eyes is probably due, both in England and in America.

While the average of the old Americans corresponds closely to the average of the English, there is a great deal of variation in both countries. The cephalic index is a good trait for comparison, because it has been calculated so extensively by anthropologists. It will be worth while, therefore, to examine this trait more carefully, to learn whether the American stock seems to be changing.

Unfortunately, it is impossible to compare the present Americans with their ancestors, because measurements of the latter are lacking. But to assume that the early colonists did not differ greatly from the modern English is probably justifiable. A comparison of modern Americans (of the old white stock) with modern English should give basis for an opinion as to whether the English stock underwent any marked modifications, on coming to a new environment.

It has already been noted that the average cephalic index is practically the same; the only possibility of a change then lies in the amount of variability. Is the American stock more or less variable? Can a "melting pot" influence be seen, tending to produce homogeneity, or has change of environment rather produced greater variability, as is sometimes said to be the case?

The amount of variability is most conveniently measured by a coefficient known as the standard deviation (σ), which is small when the range of variation is small, but large when diversity of the material is great. The following comparisons of the point at issue may be made.[5]

	Avg.	σ
100 American men.....	78.3	3.1
1011 Cambridge graduates (English males).....	79.58	2.95

For the men, little difference is discernible. The old Americans are slightly more long-headed than the English, but the amount of variation in this trait is nearly the same on the two sides of the ocean.

The average of the American women is 79.5 with $\sigma = 2.6$. No suitable series of measurements of English women has been found for comparison. It will be noted that the American women are slightly more round-headed than the men: this is found regularly to be the case, when comparisons of head-form of the two sexes are made in any race.

NO GEOGRAPHICAL TYPES

Dr. Hrdlicka's study has further given him opportunity to find whether there are any marked geographical types among the old Americans: whether, for instance, the first families of Virginia are measureably different from the Puritans of New England. He believes that they are not—that such differences as are recognized are merely those of training, habits, dress, and social customs; and that this, likewise, holds true of the westerners, whose more or less recognizable type Dr. Hrdlicka finds to be merely a matter of home influence, education and dress, and not so much of structure or physiology.

Two main objects were in view when the study of the old Americans was undertaken. One was to establish reliable norms or standards for anthropological comparisons.

The other main object in view was, as already said, to determine whether the descendants of the early American settlers, living in a new environment and more or less constantly intermarrying, were being amalgamated into a distinct sub-type of the white race. Enough has already been found, as this preliminary report shows, to prove that such amalgamation has not taken place to any important degree. The persistency in heredity of certain features,

[5] English data from K. Pearson, Biometrika V, p. 124. Thanks are due to Dr. Sewall Wright for calculating the standard deviations of Hrdlicka's data.

which run down even through six or eight generations, is one of the remarkable results brought out by the study.

If the process could continue for a few hundred years more, Dr. Hrdlicka thinks, it might reach a point where one could speak of the members of old American families as of a distinct stock. But so far this point has not been reached; the Americans are almost as diverse and variable, it appears, as were their first ancestors in this country.

Progress of Plant Breeding in Italy

Systematic plant-breeding, principally with cereals, is being carried on in ten different places in Italy, with satisfactory results. Most of the work is modeled on that of the Swedish station of Svalöf. Dr. G. Patanè, of the Italian Ministry of Agriculture, contributes a review of the work in the *International Review of the Science and Practice of Agriculture* (Rome, June, 1916), in which he enumerates the following stations:

1. Royal Experiment Station for Cereal Culture, Rieti, directed by N. Strampelli. Important work has been done with wheat during the past ten years; valuable strains have been isolated, and much hybridization done. Species and genus crosses have resulted in some novelties such as *Triticum giganteum*, a wheat the grains of which are almost equal in size to coffee beans. Barley, oats, maize, rye, pulses, potatoes, pumpkins, tomatoes, alfalfa, and other crops have been the object of work.

2. Bolognese Coöperative Society for the Production of Agricultural Seeds, directed by Prof. Todaro. It is furnishing varieties of wheat, maize and barley particularly adapted to local conditions.

3. Royal Agricultural Station, Modena, directed by G. Lo Priore. Most of its work is with wheat.

4. Royal Agricultural College, Milan. Prof. Ugo Brizi is studying cleistogamy and parthenogenesis from the standpoint of genetics, especially in the Cruciferae and Chenopodiaceæ. Cereals and Leguminosæ are being bred on Mendelian lines. Dr. P. Venino has been isolating pure lines of wheat.

5. Royal Agricultural Experiment Station, Perugia. The director, A. Vivenza, has been carrying on selection work since 1900, and for six years has been selecting in a strain which appears to be furnishing constantly small mutations, so that it can be modified by persistent selection.

6. Royal Botanical Garden, Palermo, Sicily. Director A. Borzì. Here Dr. Tropea has been trying to produce a variety of wheat resistant to seasonal changes, and also studying the coefficient of density, influence of origin of seeds on acclimatization, inheritance of acquired characters, etc.

7. Royal School of Practical Agriculture, Andria. Director L. Vivarelli is working with local varieties of wheat.

8. Vegni Agricultural Institute, Barullo, director D. Vigiani. Selection has been made of strains of wheat, oats, maize, beets, turnips, hemp, tobacco, and forage plants.

9. Agricultural Institute of Scandicci, Florence, founded and directed by Prof. Passerini. Selection of wheat.

10. Experiment Station for Rice Culture, Vercelli, director, N. Novelli. Pedigree culture of native and imported rice.

The Treatment of Criminals

Emphasizing the need for more biology in dealing with crime, Dr. Paul M. Bowers told the last meeting of the American Prison Association about his study of 100 recidivists, each of whom had been convicted not fewer than four times. Of these twelve were insane, twenty-three feebleminded, and ten epileptic, according to his findings, and in each case, he said, the mental defectiveness bore a direct causal relation to the crime committed. Other speakers agreed that those who have to deal with criminals should give more attention to the heredity and actual physical and mental condition of offenders; that they should study the natures of men, instead of only legal precedents.

SIGNIFICANT EVIDENCE FOR MENTAL HEREDITY

Much Supposed Proof Worthless—Problem Is One of Human Differences, and Must be Approached Objectively—Evidence from Twins, Royal Families, and Eminent Men—Difficulties to be Avoided[1]

FREDERICK ADAMS WOODS

Lecturer on Biology, Massachusetts Institute of Technology, Boston

ANY discussion of the significant evidence for mental heredity must aim at unravelling the part taken by heredity as opposed to external forces of nature commonly called the environment, and also as opposed to a possible internal force, acting apart from the known laws of nature and commonly called free-will. This latter aspect is usually ignored in scientific discussions of the question; but it should not be ignored. As a matter of fact, for countless ages millions of people have been, and are today, firm believers in the existence of spiritual forces capable of overcoming the material world and directing molecular change. It is easy to see that if the doctrine of reincarnation is strictly true, so that souls pass from one body to another at haphazard, and if it makes no difference whose infantile body one happens to vitalize, then there can be no mental and moral resemblance between father and son, brother and brother, sister and sister, or decreasing family resemblances as the relationship becomes more remote. The physical resemblances would be there, but the supposed spiritual resemblances would be a sham. There is no scientific reason *a priori* why this should not be so. It would be just like us to deceive ourselves on a point like this. The transcendentalist, transmigrationist, idealist of whatever school, might well say, "You scientists see the facial resemblance and you imagine the rest. You pick out instances of mental similarity between father and son or between other relatives, but these are the exceptions. Of course, out of all the people of the community you can find some instances of spiritual resemblances. Living in the same mental and moral atmosphere would account for that." The idealists might say, "We ourselves believe in education and the value of a good example. The researches of the scientists amount to nothing—they prove nothing more than a general tendency of similar traits to be found in similar home and social life."

I regret to say that a very large portion of the published literature on mental heredity is open to this criticism and proves nothing at all as to the relative importance of heredity. Many text-books, magazine articles, readable books on eugenics, books on biology containing chapters on human heredity, are worse than the primary literature itself. Why this should be so I do not know, but I suppose that in the desire of the writer to make the book or article, first of all interesting on the human side, he takes any kind of evidence that happens to make a human appeal. It is essentially a human question, and that means that it is very difficult to get a disinterested discussion. This is not true of most departments of natural science. In chemistry, physics, geology, astronomy, it makes very little difference to human pride how the theories work out, but in the question of human heredity

[1] Read in New York City before the thirteenth annual meeting of the American Genetic Association, December 27, 1916.

everyone has something at stake. The tendency is to take every argument subjectively.

THE BIAS OF HOPE

People think of themselves and of their own families, ancestors and children. And then the question of hope comes in—the wish is father to the thought. The preacher, the educator, the reformer, the mother of children does not wish to give up any part of what is for him or her a natural hope and stimulus. Then again, all people of mature years have necessarily, by force of contact with the world, some ideas about human nature and the reasons for human conduct. Very few persons have anything at stake on the nebular theory of the cosmos or the electron theory of matter. These theories can be worked out and settled without opposition from the public. But how great was the storm over the Darwinian *Descent of Man!*

If we wish to know the truth, we must cleave to truth-seeking methods, and this means the objective methods of science. In all departments of science nothing is of more importance than the taking of accurate measurements, and, if we stop to think of it, nearly all our measurements are measurements of differences. The stars are in one place one night and in a different place the next; a description of the chemical elements is a description of their measured differences. So the problem of heredity should be one of measured differences. No inductive science is absolutely accurate, but all are striving towards an increased accuracy, an ideal of perfection which loses nothing of its beauty in the impossibility of its attainment.

The first to apply scientific measurements in a large way to human heredity was, as is well known, Francis Galton. All the discussion of the inherent nature of man in all the ages, from the Greeks to the medieval churchmen, from the confused philosphers of the period of Rousseau, even down to the transcendentalists of almost our own time, was not worth as much as the work of this one man, incomplete and fragmentary as it necessarily was. Curiously enough the year 1865, in which Galton first published, was also the year in which the now celebrated Mendel first gave his results to the world. Neither of these men was aware of the existence of the other, much less could have imagined the, to a considerable extent, needless and, at times, bitter controversy that was to arise among such of their followers as were unable to grasp the whole subject and see wherein both methods could be harmonized and accepted as leading towards one great truth. Whatever one may think of the relative value of the methods of Galton and the methods of Mendel as regards inheritance among plants and animals, there can be no question that, so far as human psychological inheritance is concerned, the work of Galton and the methods founded and developed by Galton and Pearson are of vastly more importance, at least as regards work already done.

HUMAN PROBLEM DISTINCT

It is no use to say that the same laws must apply to plants and animals as apply to man. Only in the most generalized sense is that true and then, perhaps, only for certain laws and not for others. As far as heredity and environment are concerned, our own problem contains right on the face of it something that makes it very certain that the same laws cannot apply. It is inconceivable that environment should act just as much on one individual as on another, that all creatures should be equally at the mercy of their various environments, that some cannot escape from or choose their environments better than others. Certainly the human brain is either more affected by its environment than the brain of a worm or boll of a cotton plant, or else it is less affected. Since our major problem, significant evidence of mental heredity, needs just that unravelling of the heredity-environment complex, our very first problem is to find out if the brains of men, the brains of average men, of great men, of children, of women, of eminent women, of different classes of men, of different races, separately not collectively, are more or less

affected by their environment than the brains of dogs and cats, of worms and mollusks. Not only in the heredity-environment complex are there sure to be great differences between higher and lower types in their reactions to their surroundings, but if we have also the problem of free-will to deal with—and we certainly do have it to deal with and perhaps it will be one of the last and most scientific problems of all—then, it is not presumptuous to suppose that free-will acts somewhat more in a man than it does in a tree. At any rate, if there is any such thing demonstrable, there will be .differences and these differences will be measurable.

A PROBLEM OF DIFFERENCES

And this brings us back to the crux of the whole question. The heredity-environment tangle can never be unravelled until it is made into a problem of differences and as far as mental and moral heredity is concerned, there have been very few pieces of evidence found that can be called significant in this respect. But these few are very significant up to a point, as I shall show later.

To explain the method of differences it is best to take a single example. A factory manager wishes to test an "efficiency scheme." He keeps all the conditions as nearly as possible the same, introduces his novel method, and if a notable result follows he is justified in ascribing it to the new scheme, or at least he has a probability in his favor, and if he experimented long enough he might approach practical certainty. Such an experiment would not solve the heredity-environment problem, but it would be a very real contribution, though a very minor one. What it would show would be just what influence one particular change in the environment would be likely to have on one particular type or class of men. There would be every reason to suppose that in other manufacturing plants, with about the same sort of workmen, about the same sort of result would be obtained.

All this throws no light on heredity in worms and fishes, but for man it does throw clear light as far as it goes; it gives a valuable and definite answer. It is of a type that I believe researches must be if they are best to contribute to the solution of the heredity-environment problem. One of the two factors must be kept virtually stable or unchanging during the experiment, while the other is observed to change. Many experiments along such lines are being performed all the time at agricultural stations; for example, the soil is fertilized in several little adjacent plots with different sorts of fertilizer, the seed being always samples from the same lot; the measured differences in the results represent the practical value of the differences in the fertilizers. In the same way if the soil, moisture, sunshine and all the conditions that affect growth be kept as constant as possible, the monetary value of different seeds, of different ancestral strains and crossings can be gradually determined. Thus an essentially practical science of the subject is built up, each experimenter adding something, provided his experiment has been properly conducted.

WRONG STATEMENT OF CASE

It is a waste of time to argue whether for any one individual, heredity or environment is more important. Each is, in a sense, entirely important. *Some* changes in the environment are more important than others, some even leading to death of the organism. *Some* changes in the germ are more important than others, as they lead to trivial or fundamental alterations of adult structure, but there is no way that I know of to make the consideration of them anything more than a verbal quibble except to specify definite particular traits, which for some reason or other seem interesting or significant, and then to measure those traits by what I have spoken of as the method of differences.

It is not easy to get good material for psychological inheritance which can be dealt with in this way. Generally when the heredity is different, as for instance among the various social classes, wealth, education and all the

other "atmospheric" conditions are also different. We cannot experiment *ad libitum*, as the agriculturist does, but there are already certain curious collections of data either discovered or compiled which give us a chance to test the same heredity under shifting circumstances, or the effect of a varying germ-plasm developing under uniform conditions. One of the first instances to be utilized and one of the most interesting is the evidence from various sorts of twins. It is known that there are two sorts of twins. The true or "identical" twins are developed from a single original cell which at some very early stage divided to form two individual beings. These "identical" or "duplicate" twins have a nearly (though never an absolutely) identical germplasm or heredity. Ordinary brothers and sisters are not nearly as identical in their origin. They spring from cells necessarily somewhat similar though not nearly so much so. Fortunately for our knowledge of heredity it often happens that brothers and sisters are born at the same time, who are also called twins, but are in a different category from the true or identical twins. These are on the same basis for hereditary resemblance as ordinary brothers and sisters, and are known as "fraternal" twins. As far as we can see, home environment for the "identical" twins is no more identical than for the "fraternal" twins. In both cases there are slight differences which tend to become greater from the start, but not more in one than the other. If they are of the same sex the parents commonly do not know which variety they are. As the twins grow up they may remain very much alike in mental characteristics or they may diverge as much as ordinary brothers and sisters.

THE TWO KINDS OF TWINS

Thorndike[2] presents some evidence to discredit the commonly accepted view that there are absolutely two kinds of human twins or, rather, that any considerable percentage of twins develop from one fertilized egg. He finds all degrees of gradation in his measurements of New York school children, but I am inclined to think that there are two kinds of twins from the embryologist's point of view, in spite of the gradation in measurements. We know that there are in the widest extreme two kinds. Those of different sex must come from two distinct ova, each fertilized by a separate sperm. Our present knowledge of sex causation, and of the accessory chromosome, makes it almost certain that those of opposite sex are from two ova and two spermatazoa. If this is true for opposite sexes, why not for the same sex? There should be as many more of the same sort who happen to be of the same sex, boy and boy, or girl and girl. We also know from embryological evidence that it is possible to have two persons derived from the single fertilized ovum. No one denies this. Therefore, what seems to me most likely to explain all the facts is that in the case of identical twins, if the single cell splits early and uniformly into two almost identical parts, we get the closest approximation to identity. If the division takes place in the four or eight cell stage or later, or if for any reason the chromosomes are not so evenly divided, even if the separation took place in the one cell stage, then the adult resemblance would be less strong.

The fact that there is lack of agreement on this point does not make the evidence from twins without significance for mental heredity, but it does call into question whether we can be sure that we are dealing with a very much more identical germ-plasm in one class of cases than in another. Therefore we cannot very well apply all of the tests of "heredity the same," "environment changed" that I advocated in what I call the method of differences.

Some comparison of this sort can, however, be made. For instance, twins between 9 and 14 years of age were tested in two ways: first, in their ability to add and multiply figures,

[2] Measurements of Twins, Archives of Philosophy, Psychology and Scientific Methods, No. 1, New York, 1905.

This sort of work is very susceptible of improvement through training, but they were virtually just as much like each other in the second test, *i.e.*, their ability to do puzzles which they had never seen before. This is just what we should expect if inborn causes were back of the great mental similarity of twins; but it does not prove that heredity and environment working together may not have caused the striking resemblance. It does not separate heredity from environment except on the specific point of training in arithmetic. It shows a failure of environment to make itself manifest.

Again, older twins and younger twins were compared. There were two groups—one 9 to 11, and one 12 to 14 years of age. The older twins showed no closer resemblance than the younger. The twins would, through the inherent tendency to diversification, tend a little towards dissimilarity merely through the three years of aging. They do, as a matter of fact, become a little less similar during the three years.

This shows that there was nothing in the identity of the home and school life at that time to mold them to one type.

THE MIND AND THE BODY

Although we cannot much separate heredity and environment specifically by the use of present day data concerning twins, they yet furnish a great deal of evidence that is significant for mental heredity. The fact is significant that all the measurements show the similarities to be on the average as strong for the mental as for the physical. The fact that they are, for instance, just as much alike in their ability to solve new puzzles as they are in the color of their eyes is very significant, since eye-color differences are known through Mendelian experiments to be foreshadowed by differences in the germ-plasm.

For actual measurements of the effect of a changing environment we must keep the heredity factor constant or virtually so. In the efficiency experts' experiment this requirement was sufficiently fulfilled. In the case cited of the seed and the fertilizers, we are satisfied that we get a large enough degree of identity in the seed by taking a large enough number of seeds for samples. In the same way human environment values could be tested by using a large enough number of cases to insure equality of germ-plasm in two groups under differing imposed environments. The careers of younger sons and of older sons in the British nobility and gentry ought to furnish material. All the sons ought to average about the same heredity, whether they are younger or older. There is a good deal of dispute on the question of the first born being different from the others. The first born appears to be more able, and also, curiously enough, more unable. If he is more apt to be a college professor he is also more apt to be a criminal or a high-grade imbecile. All this may be a statistical fallacy or due to something surrounding the conditions of the birth of a first born, survival values, etc. The point, so far as it concerns us, is that it has to be taken into consideration. But let us suppose that we found very different mental characteristics between second sons and third sons: I would say that this might be a good example of the power of environment to modify traits.

EFFECT OF SELECTION

Some of it would be due to characters naturally fitting into their careers of the army, the law or the church, but some of the differences, if found, would probably be due to the power of a convention or habit of society to produce mental and moral differences. We should have to follow out the careers and know to what extent men actually selected or stuck to congenial occupations. If the church is only made up of those men who find the life congenial to their natures, then, of course, this group of sons will have different traits from those who stick to the army. The whole question is—and this must always be thought of—is there a constraint imposed or is there not? In most of the experiments on animals a very severe restraint on freedom of choice is imposed.

I was able to make one experimental

or statistical test of the effect of a peculiar social restraint or law on a certain class of persons, in data which I had collected for inheritance in the royal families of Europe. Some members of the family reach the throne and become sovereign rulers, while others do not. Here, then, are two distinctly different psychological environments acting on the same heredity, or more strictly speaking, virtually the same average heredity which we secure on the same principle as the agricultural experimenter who takes two handfuls of seed from the same bin. I think everyone would have supposed that a part, at least, of the intellectual eminence of Frederick the Great, Peter the Great, or Gustavus Adolphus was due to the fortunate opportunity of an exalted official position. Perhaps this is true; I cannot say that it is not true; but if it is true to any considerable extent, why does it not show itself between sovereigns and their younger brothers? Here is a definitely measurable difference of environment, which, as far as I have been able to see, has no particular effect one way or another.

The eminence of the younger sons is just as great as that of the actual rulers. In 403 cases[2] it does not show itself to any significant degree. All this sets us thinking. It does not disprove that exceptional opportunity has favored the sovereign, for it may be that opportunities of kingship have favored him and other opportunities just as beneficial have favored the younger sons. All it shows is that a certain specific difference in opportunity has been unable to make itself felt. Therefore, it is not right to say that kings are favored by their peculiar opportunity of kingship.

GREAT MEN AND THEIR KIN

Another instance of failure of opportunity to produce a measurable difference is obtained from a comparison of the great men of America with the great men of Europe. The proportionate number of great men in European history who are related to other eminent persons is well known from the investigations of Galton, de Candolle and Ellis. The proportion for men of the highest type is about one in two. That is, one out of every two has an eminent blood relation as close as great-grandparent or great-grandson. This is far greater than the average expectation, but it does not prove anything against the influence of nurture since these very men necessarily, more than common men, were brought up in exceptional environments. My own investigations into the family history of great men in the United States show that the ratios are not different in this country. This fact does not prove that the Americans have not also been benefitted by the traditions and educational advantages of belonging to good families, but it does prove that supposed superior opportunities in the newer country have not produced an easily measurable difference.

Where, then, can environment be expected to be found working at its maximum or surely making itself felt to some measurable extent? Certainly environment has some influence. The present war teaches us that, for the same men in Europe are very different men in outward action and inward thought from what they were in June, 1914. It is also highly probable to my mind that not only great national crises, but also slowly developing national forces, when under the firm and constant leadership of some very great man or collection of men, profoundly alter for a time the thoughts and activities of large numbers of men.

On the other hand, the significant evidence for mental heredity is very considerable. The correlation ratios for mental and physical traits, the facts of alternative mental heredity, all have their significance and value, even if they do not separate internal from external forces. The justification for all this is too long a story to enter into here, and I have not attempted in this paper to enumerate the results. My aim has been, rather, to point out a method of procedure for future re-

[3] *Science*, June 19, 1914.

searches and to show the distinction between measuring heredity with environment, both inextricably working together, and measuring either of these forces apart from the other, which latter class of researches, I believe, will more and more build up a true practical science of eugenics.

Race Hygiene in Germany

Widespread interest is aroused by the war for all questions relating to eugenics and race hygiene. The aim is chiefly positive, *i. e.*, directed towards the higher propagation of the fit. A large number of valuable pamphlets have appeared on the market and several new societies have been founded. Besides the "Deutsche Gesellschaft für Rassenhygiene (München)," with several locals in the empire, there exists now a well organized "Deutsche Gesellschaft für Bevölkerungspolitik" with headquarters in Berlin, which mainly wants to check the declining birth rate. In Halle the "Gesellschaft für die Erhaltung und Mehrung der deutschen Volkskraft," in Düsseldorf, the "Gesellschaft für Familienwohl" and in Frankfurt the "Rhein-Mainische Gesellschaft für Bevölkerungspolitik" follow the same course. A central organization of many societies of different character (labor unions, women's organizations, Christian clubs, etc.) but all interested in race hygiene was called into life, the affairs being carried on temporarily by the "Deutscher Sittlichkeitsverein" in Berlin-Plötzensee. This central organ largely represents societies which see in race hygiene and eugenics a moral question. Great masses of the average population stand behind the societies affiliated. One of the consequences of the war is that more stress is being laid upon the moral side of the question and the greatest enemy of positive eugenics is seen in the egoism and luxury of modern life which destroy the family and check the birth rate.

Of negative eugenics the question is much debated whether and how the marriage of people afflicted with venereal diseases should be checked. No haphazard legislation is wanted. For instance the *Ärzteverein* in München discussed this question about a year ago, but without reaching a conclusion. The best solution seems to be that all veneral diseases be made declarable, that every person afflicted with such a disease be obliged to cure himself, that the contamination of another person with venereal disease be made a crime and that people declared to be afflicted with a contagious venereal disease be prohibited from marriage. The German conception of race hygiene, as is seen also in this case, embraces more than the American idea of pure eugenics, as it is thought that eugenics and other phases of social life are linked together in a way which demands a common consideration of all our social institutions from the viewpoint of the benefit of future generations.

G. von Hoffmann, Berlin.

The Microscope in Zoölogy

ANIMAL MICROLOGY. Practical exercises in zoölogical microtechnique, by Michael F. Guyer, Professor of Zoölogy in the University of Wisconsin. With a chapter on drawing by Elizabeth H. Smith, Instructor in Zoölogy in the University of Wisconsin. Pp. 290, with 74 figures. Revised edition, price $2 net, postage extra. Weight 1 lb. 10 oz. Chicago, the University of Chicago Press, 1917.

Dr. Guyer's handbook has now been in use for ten years and is generally recognized as one of the most practical and satisfactory works on microscopic technique which has been written. It is intended primarily for the beginner, but will be found useful by anyone who does microscopical work. This new edition contains descriptions of many new methods, and a chapter on cytology which gives full directions for study of chromosomes. Geneticists are coming more and more to realize that their breeding work should be checked up by the use of the microscope, and Dr. Guyer's book should be of much value to them.

POLAR BEAR CACTI

Analogies between Polar Bears and Shaggy-Haired Cacti of the High Andes of Peru As Examples of Adaptation to Special Conditions of Existence

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Bureau of Plant Industry, Washington, D. C.,
and Alice Carter Cook

THE polar bear represents one of the traditional examples of adaptation to special conditions of existence. It is easy to understand that a dark colored bear or a short haired bear would be at a great disadvantage among the arctic snow fields. The polar bear differs from all his kindred in these two features that are necessary to make him a success in his own peculiar environment.

It seems clear in such cases that there is a real relation between the special characters and the special environment, and many writers have believed that the relation was one of cause and effect, that in some way or other the environment itself had produced the appropriate characters. Many, indeed, have gone further and urged that all characters must have environmental importance, and hence that the environment must be the underlying cause of the evolutionary progress of species. Nevertheless, nobody has explained how the external conditions are able to bring about evolutionary changes in species. Environmental causes of evolution have not been found, in spite of a century of search by Lamarck and Darwin, and their numerous followers. The relation between evolution and environment is still to be considered as an open question, in view of the widely divergent opinions that continue to be expressed by writers on the subject.

Adaptation may be defined as the possession of characters of environmental fitness. In a sufficiently general sense all characters may be considered as adaptive, for if any were definitely nonadaptive they would interfere with the existence of the species. Nevertheless, some characters are much more obviously adaptive than others, as in this case of the polar bear, the only member of its group that is able to live in its special environment by virtue of peculiar characters, the lack of which appears to exclude other species.

A CACTUS OF THE ANDES

In the Southern Hemisphere is another example of adaptation which may be compared to this of the polar bear. Many exposed slopes on the bleak plateaus of the high Andes are dotted with clumps of pure white cacti that look from a distance like small masses of snow. On closer view, the shaggy white hair of these cacti makes them appear like small sheep or poodle-dogs, or like reduced caricatures of the denizens of the arctic regions. We are so accustomed to think of cacti primarily as desert plants, peculiarly adapted to hot, dry deserts, that they seem distinctly out of place on the cold plateaus of the high Andes of southern Peru.

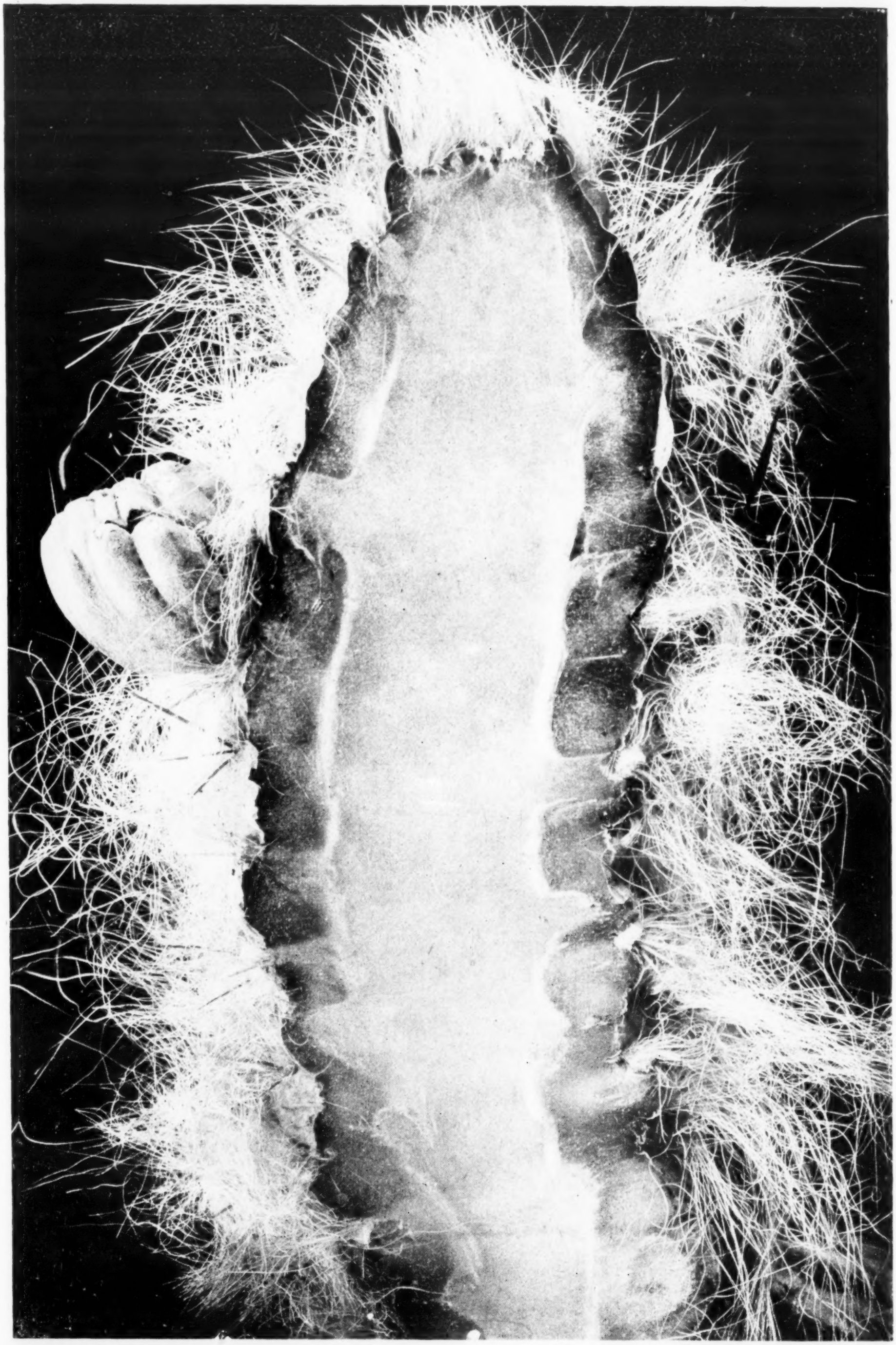
Some long-haired or canescent cacti are found in lowland deserts. Hair several inches long covers the young plants and the growing parts of older ones so suggestively that they are popularly known as "old men" or "old women." These hairy desert forms, however, do not seem to enjoy any important advantage over their unprotected, naked relatives that are just as common in these same localities. But in the high Andes there is a species so entirely covered with long white hairs that it may appropriately be called the Polar Bear Cactus. In some localities it is very abundant, dotting the grassy slopes like flocks of diminutive sheep

CLUMP OF POLAR BEAR CACTI AT ELEVATION OF 14,000 FEET

At a distance, a plain dotted with such clumps looks as if it were covered with grazing sheep. All cacti are highly specialized plants, adapted to live in places where there is very little moisture; but this cactus must be still more specialized, for it not only has to face the absence of water in the soil and air, but the effect of a high altitude, where the cold is intense at night but the sun excessively hot by day. The cactus here shown seems to be as well fitted for its environment as the polar bear is for the ice floes. (Fig. 3.)

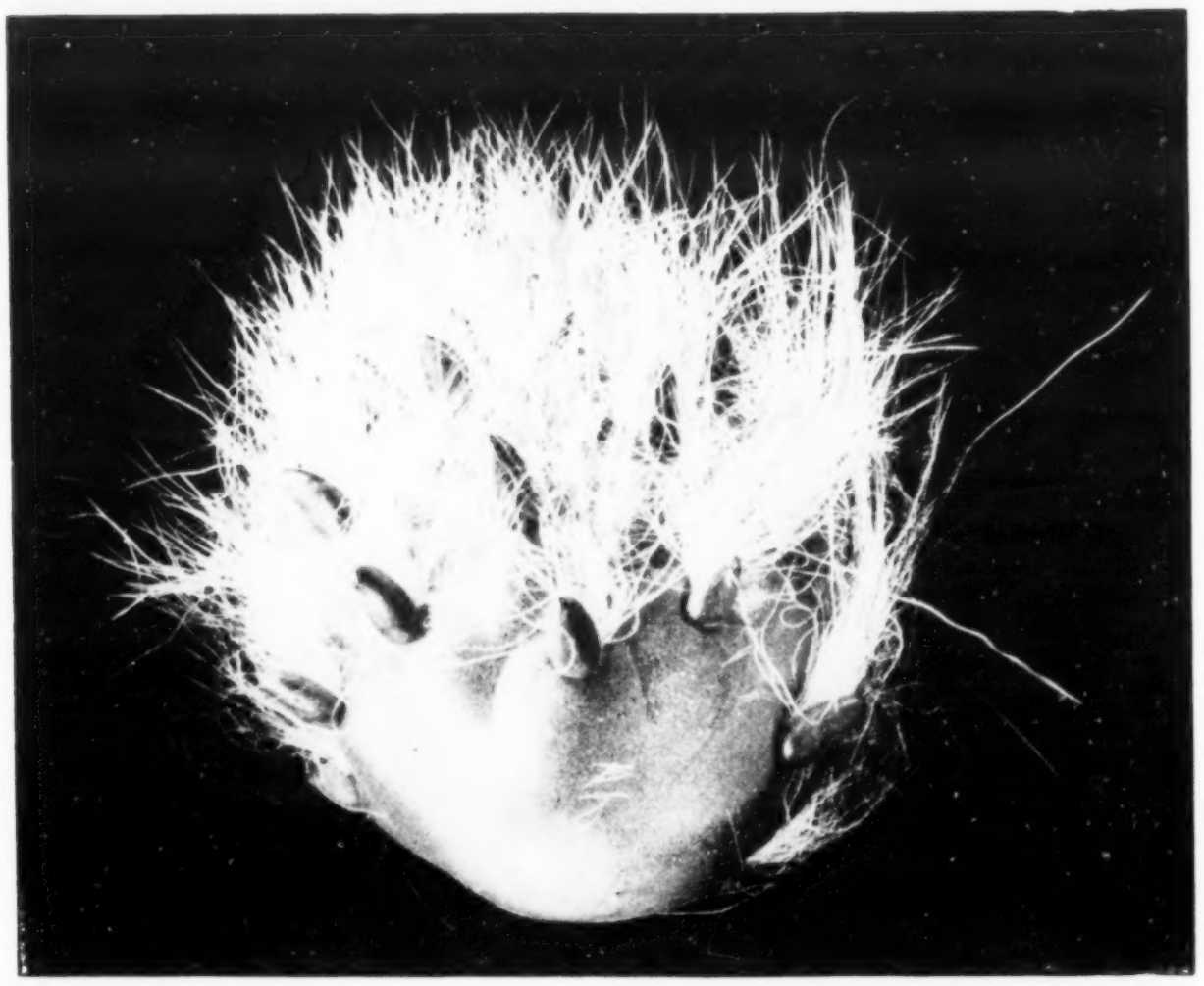
ROOT SYSTEM OF THE CACTUS

Two mature plants of *Opuntia floccosa* on the rim of a gully. One of them has fallen into the gully but remains suspended by its strong tap-root. The root system of a cactus on the high Andean plateau must go deep into the earth, not only to get what little moisture there may be, but to anchor the plant firmly and prevent it from being blown out of the ground. (Fig. 4.)



A BRANCH CUT OPEN

The branch of *Opuntia floccosa*, shown natural size above, has been cut open lengthwise to show the succulent, watery interior, the covering of long, white hairs, the spines concealed among the hairs, and a fruit on the left side. The principal value of these hairs to the plant is probably to prevent excessive transpiration of moisture, under the powerful mid-day sun whose effect is increased by the rarified atmosphere of the high plateaus. (Fig. 5.)



YOUNG BRANCH WITH LEAVES

The little conical buds shown on the above shoot, which is photographed natural size, are the true leaves of the cactus. They are soft in texture, and fall off before the branch has attained great size. They are mere vestiges of the leaves that the cactus had at some much earlier stage in its evolution, and at present they seem to serve no useful purpose. (Fig. 6.)

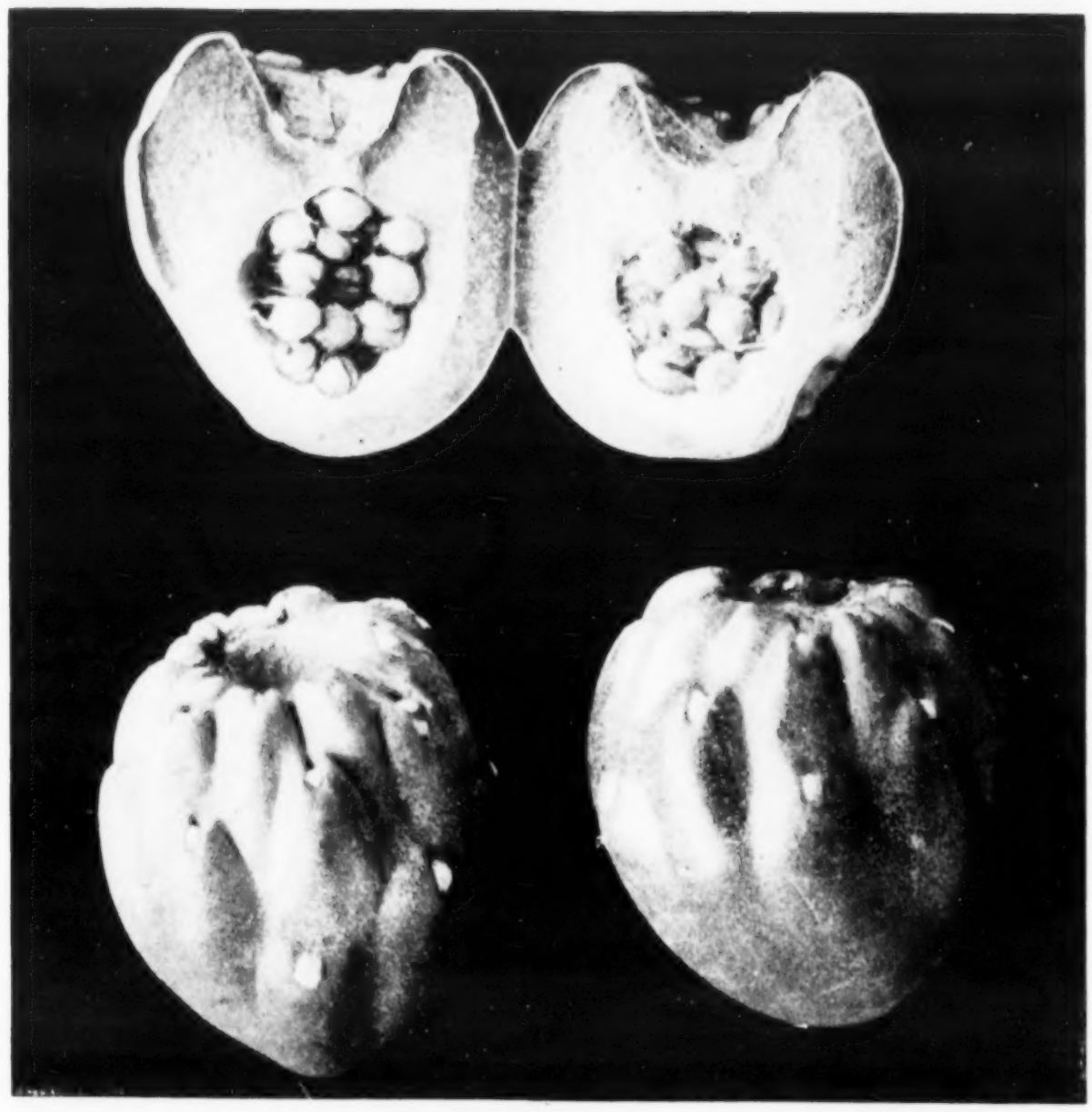
and sometimes closely covering square rods of surface like a coarse, woolly blanket. (Fig. 3.)

Although the "polar bear cactus" does not resemble its namesake in having exclusive possession of its peculiar environment, it may be a good example of adaptation. For, although two or three naked species grow even to so great an altitude as that of the summit of the Pass of La Raya, that is, at an elevation of more than 14,000 feet, they certainly show no such comfortable prosperity as the shaggy form. The naked species are relatively scarce and small. The Andine cactus flora would attract no attention from the traveler if the shaggy species were not there.

A NAKED FORM

One of the naked cacti is so closely related to the shaggy form as to be referred to the same species, *Opuntia floccosa*, by Dr. J. N. Rose, of the U. S. National Museum, the best authority on this group of plants. The difference may lie only in the length of the spicules, which are as short as in ordinary cacti. The existence of this naked form is another evidence that the shaggy coat is not indispensable, but the unclothed plants are much less common, and this indicates that the hair is distinctly advantageous. The naked plants appeared distinctly shrunken even at the beginning of the Peruvian winter, like our native *Opuntia vulgaris*, which grows as far north as Washington, D. C.; but the hairy Peruvian cacti were still plump and succulent, as in the specimen shown in Fig. 5, representing a photograph taken at Araranca, on the 13th of April, 1915.

According to Weberbauer this species extends northward from the Titicaca basin to about 10° south latitude. Another white hairy species, *Opuntia lagopus*, is found only in the region of Lake Titicaca. Weberbauer has published a photograph of the two species growing together in the vicinity of Poto,



FRUIT OF POLAR BEAR CACTUS

The fruit of *Opuntia floccosa* is here shown, natural size. It will be noted that while the plant is strongly protected by spines and hairs, the fruit is quite naked. Possibly this is to make it edible for animals and thereby promote the distribution of the seeds. The naked fruit is also better adapted to rolling down hill, and thereby spreading its seeds, than a spiny, hairy, fruit would be. (Fig. 7.)

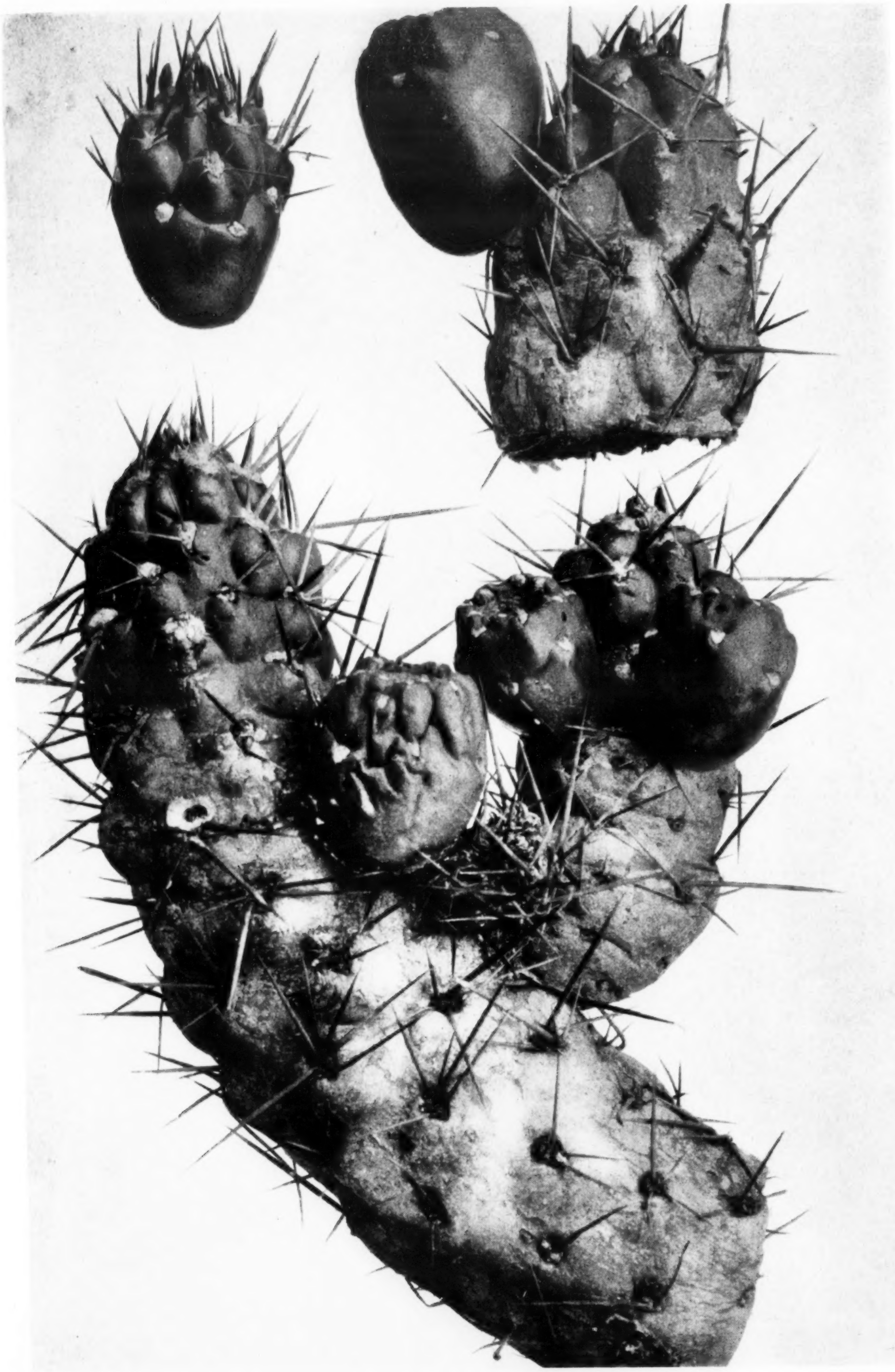
at an altitude of 4,500 meters, nearly 15,000 feet.[1]

One of the difficulties attending the study of adaptation is that of determining definitely the use of the specialized feature. Interpreting the uses of peculiar characters is a fertile field of speculation, as the history of the subject abundantly shows. Appearances are often very deceptive or, at least, have often proved very misleading. Finding a cactus with a shaggy coat on the bleak tablelands exposed to nightly frosts in winter has naturally suggested that the hairy covering is a protection against cold, but the fact may be quite the opposite. In the rare atmosphere of the highlands the sun has a scorching power that is probably much more trying to the plant than the cold. Even at temperatures above freezing, plants are often killed by too sudden exposure to the sun after a cold night, while those in shady situations survive. With stems and roots chilled, the demands of rapid transpiration cannot be met and the heated tissues collapse.

PROTECTION FROM THE SUN

With such facts taken into account it is easy to understand that a coat of hairs may be even more useful to keep the plants from warming up too suddenly than to be a protection against cold. The cooling of the plant may be somewhat retarded by the hairs, but this can hardly be of as much importance as the protection assured by the hairs against the injurious effects of sudden exposure to the heat of the morning sun. The practical bearing of this idea has been recognized by fruit growers who

[1] Weberbauer, A., 1911, Die Pflanzenwelt der Peruanischen Anden, p. 195, pl. 15.



THE RARE NAKED FORM

The cactus above shown (natural size) is closely related to the polar bear cactus—it has even been supposed to be the same species. It grows in the same localities as the hairy form hitherto shown, but is much rarer, and at high altitudes appears to be less thrifty. This suggests that it is unable successfully to compete with the more specialized and better adapted polar bear form, whose long hair gives it an advantage on the high Andean plateau. (Fig. 8.)

whitewash their trees in the winter to reduce the danger that sunny weather in spring may cause premature flowering and subsequent injury by freezing of the young fruits.

The analogy between the cacti and the polar bear may, then, be real. As a coat of white fur, because of its nonconductivity of heat and cold, may be useful to an animal that is exposed to the fierce sun in the long days of the arctic summer, so the dense hair of the shaggy cactus may serve as a protection against extremes of heat and cold. The development of shaggy coats in the Andine cacti is in line with the other specializations that they have adopted to enable them to exist under extreme conditions of exposure that plants of many other families are unable to tolerate.

Compared with most other flowering plants, the cacti are enormously specialized, the plant body being reduced to mere thickened stems. The leaves, which are such important organs in most of the flowering plants, are either lacking altogether or are represented in merely rudimentary form. In *Opuntia floccosa* the leaves are found only on the young shoots, completely hidden in the dense covering of hairs. They are the small cones with spiny tips that can be seen among the hairs in Fig. 6.

That adaptations are difficult to interpret does not mean that they are the less real. A single character may serve adaptive purposes in a variety of ways, the more the better, and, in the ability of plant and animal life to produce characters which lend themselves to environmental selection may properly be sought the explanation of the evolutionary processes which are the crowning marvel of life.

Economics and Eugenics

ESSAYS IN SOCIAL JUSTICE, by Thomas Nixon Carver, Ph.D., LL.D., David A. Wells Professor of Political Economy in Harvard University. Pp. 429. Price, $2.00 net. Cambridge, Harvard University Press, 1915.

Eugenics consists of a foundation of biology and a superstructure of sociology and economics. Galton emphasized the two parts in due proportion, but until recently sociologists and economists have been indifferent or hostile to eugenics, and have left it in the hands of biologists, who have naturally tended to emphasize the biological principles underlying eugenics, but have paid too little attention to their application. Prof. Carver (although he hardly alludes to eugenics by name) has made a valuable contribution to applied eugenics in these essays, in which he considers the nature of a strong state and the ways in which its strength may be increased. Starting from Darwinian principles, he concludes that properly controlled competition offers the best hope, but that direct action is also needed to limit the numbers of the unproductive and inefficient. The fundamental doctrines of economics are described in language free from technicalities and tested, in effect, by the criterion of eugenics. Those who are interested in seeing eugenic reforms actually put into effect cannot afford to overlook this book, which marks a very important step in the coördination of the various sciences which make up applied eugenics.

Growth of Provision for the Feebleminded

Describing the problem of caring for the feebleminded, Dr. Walter E. Fernald contributes a valuable review to the first issue of *Mental Hygiene*, the new quarterly magazine of the National Committee for Mental Hygiene. Most of the United States now make some provision for mentally defective persons, Massachusetts taking first rank in this respect, while Ohio, Minnesota and Iowa have always been leaders. In the following, there is no state institution of any kind for either feebleminded or epileptics: Alabama, Alaska, Arizona, Arkansas, Delaware, District of Columbia, Florida, Georgia, Louisiana, Mississippi, Nevada, New Mexico, South Carolina, Tennessee, Utah and West Virginia. In some of these, steps have been taken to remedy the lack.

EUGENIC ASPECT OF SEXUAL IMMORALITY

Those Affected Are Inferior In Eugenic Quality and the Decrease of Their Racial Contribution Is Directly a Gain Rather Than Loss—Social Hygiene Therefore Opposed to the Eugenic Movement[1]

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SO WIDESPREAD is the confusion in the minds of the general public as to the distinction between eugenics, sexual hygiene and the sexual purity propaganda that sexual morality is thought by some to be substantially synonymous with eugenics or to be included by it.

On a previous occasion[2] I have protested against this extension and modification of the valuable word "eugenics" as defined by Galton. It is my purpose here to analyze sexual immorality in order to see to what extent it may have eugenic and dysgenic effects.

Let us consider first whether sexual immorality increases or decreases the marriage rate of the offenders. We may conclude that it reduces the marriage rate. Although it is true that some individuals of less strong sexual passion might by sexual experience become so awakened as to be less satisfied with a continent life and might thus in some cases be led to marriage, yet this is more than counterbalanced by the following considerations:

1. The mere consciousness of loss of virginity has led in some sensitive persons, especially women, to an unwillingness to marry from a sense of unworthiness. This is not common, yet I have known of such cases.

2. The loss of reputation has prevented the marriage of the desired mate. This is not at all uncommon.

3. Venereal infection has led to the abandonment of marriage. This is especially common.

4. Illicit experiences may have been so disillusionary, owing to the disaffecting nature of the consorts, that an attitude of pessimism and misanthropy or misogyny is built up. Such an attitude prevents marriage not only directly, but also indirectly, since persons with such an outlook are thereby less attractive to the opposite sex.

5. A taste for sexual variety is built up so that the individual is unwilling to commit himself to a restriction of that variety.

6. Occasionally, threat or blackmail by a jilted paramour prevents marriage by the inability to escape these importunities.

We consider next the relative birth rate of the married and the incontinent unmarried. There cannot be the slightest doubt that this is vastly greater in the case of the married. The unmarried have all the incentives of the married to keep down the birth rate in addition to the obvious powerful incentive of concealment as well.

Passing to the relative death rate of the illegitimate and legitimate progeny, the actual data invariably indicate a decided advantage of the legitimately born. The reasons are too obvious to be retailed.

THE QUESTION OF QUALITY

Now then, knowing that the racial contribution of the sexually moral is

[1] Read in New York City at the thirteenth annual meeting of the American Genetic Association, December 27, 1916.

[2] Eugenics and So-called Eugenics. Am. Jour. of Sociology, July, 1914, Vol. xx, pp. 98–102.

greater than that of the sexually immoral, to get its evolutionary effect, it remains to compare the quality of the sexually moral and immoral.

For this purpose we should distinguish between the individual who is chaste till the normal time of marriage and then marries and whose sexual life is truly monogamous, and that abnormal group who remain chaste and celibate to an advanced age. Strictly speaking, these last are not moral, if they have valuable and needed traits, because their failure to reproduce affects decidedly adversely the welfare of their group in the long run. While the race suffers through the failure of many of these individuals to contribute progeny, probably in the long run it does not so far as males are concerned as much as might be supposed. Such individuals are often innately defective in their instincts or, in the case of disappointed lovers, may have a badly proportioned emotional equipment, since it leads them into a position so obviously opposed to race interests.

But, to pass to the essential comparison, that between the sexually immoral and the sexually moral as limited above, it is necessary first of all to decide whether monogamy is a desirable and presumably permanent feature of human society.

We conclude that it is:

1. Because it is spreading at the expense of polygamy even where not favored by legal interference. The change is most evident in China and India.

2. In monogamy, sexual selection improves valuable traits of character, rather than mere personal beauty or ability to acquire wealth; and

3. The greatest amount of happiness is produced by a monogamous system, since in a polygamous society so many men must remain unmarried and so many women are dissatisfied with sharing their mates with others.

Assuming this, then adaptation to the condition of monogamous society represents race progress. Such a race profits if those who do not comply with its conditions make a deficient racial contribution. It follows then that sexual immorality is eugenic in its result and that, if all sexual immorality should cease, an important means of race progress would be lost. We have an illustration in the case of the negro in America, whose failure to increase in number faster than whites is attributable to the widespread sterility resulting from venereal infection. Should venereal diseases alone be eliminated, we would expect that race immediately to increase in numbers faster than the whites.

It may be felt by some that this position would have an immoral effect upon youth if widely accepted. This need not be feared. On the contrary, I believe that one of the most powerful factors in ethical culture is pride due to consciousness of being one who is fit and worthy.

The traditional view of sexual morality has been to ignore the selectional aspect here discussed and to stress the alleged deterioration of the germ-plasm by the direct action of the toxins of syphilis. The evidence relied upon to demonstrate this action seems to me to be vitiated by the possibility that we had, instead, a transmitted infection to the progeny. We cannot then credit such an action since it is so highly improbable from analogy until it has been demonstrated in cases where the parents have been indubitably cured.

Is it necessary, then, to retain sexual immorality in order to achieve race progress? No, because it is only one of many factors in race progress. We can mitigate this as well as alcoholism, disease, infant mortality—all powerful selective factors—without harm, provided we make up for it by increased efficiency of other selective factors such as the segregation of defectives, more effective sexual selection, a better correlation of income and ability, and a more eugenic distribution of family limitation.

THE TEXAS PALMETTO

A Distinct and Valuable Species Which Has Been Destroyed So Rapidly That It Now Exists in Only One Grove—Desirable to Preserve It for Future Planting

IT IS not generally known that the largest palmetto palms in the United States are not in Florida or other Atlantic Coast States, but in southern Texas. The Texas palmettoes do not belong to the same botanical species as the Florida palms, but are quite distinct in general appearance as well as in botanical characters. The trunk is much more robust, the leaves are larger, the leaf segments are broader, and of firmer texture. The fruit has a sweet edible flesh surrounding the seed, like the fruit of the date palm.

The only natural grove of this interesting tree that now exists in the United States, or that is known to exist anywhere, is on the banks of the Rio Grande near Brownsville. Accounts of early settlers in the coast districts of South Texas indicate that the native palmetto extended in former years much farther north, where now only a few scattered individuals remain.

Botanists at first supposed that the Texas palmettoes were the same as the Mexican palmetto (*Sabal mexicana*), but afterward this was found to be a mistake and in 1901 the Texas palmetto was recognized by O. F. Cook as a distinct species, under the name *Inodes texana*. In addition to other differences, the Texas palmetto is a very much larger palm than the species to which the name *mexicana* properly belongs.

The Texas palmetto is also entirely distinct from the small, low-growing "scrub-palmettoes" of the river bottom forests of East Texas. These plants have only a few leaves, borne on slender subterranean or creeping stems, whereas the Texas palmetto is not only a truly arboreal palm, but is one of the most imposing of all the palms that are able to live outside the Tropics.

FEW HARDY PALMS

The entire palm flora of the world affords only a few hardy species that attain the proportions of trees and are suitable for planting in the warmer parts of the United States. The Texas palmetto represents an important addition to the series of hardy palms. It has been supposed that the Washingtonia palms of California are the hardiest of all, but the Texas palmetto is even more resistant to cold. Washingtonia palms have grown to maturity in several of the parks at San Antonio, Tex., but the leaves are often killed in cold weather that has no effect upon the leaves of Texas palmettoes standing in the same parks. Now that South Texas is occupied by a permanent and rapidly increasing agricultural and urban population, the time must soon come when the value and interest of a native palm, fully adapted to the South Texas conditions, will be highly appreciated. The preservation of the grove at Brownsville is necessary in order to insure an adequate supply of seed for general planting.

The prospective value of the Texas palmetto for ornamental planting in streets, parks and private grounds would amply justify the effort that is necessary to keep it from extinction. Palms are likely to have a special value in South Texas because plants of this family, like their relatives the grasses, appear to be immune to the root-rot fungus, which often destroys fruit and ornamental trees of other families.

The single remaining grove of the Texas palmetto, preserved in its original beauty, is situated 7 miles from the city of Brownsville in a location sheltered from the northers in a picturesque bend of the Rio Grande, which makes it still possible to perpetuate for coming generations this remarkable palm and the landscape scenery which its stately forms produce. This unique grove of palms is the property of Frank Rabb, of Brownsville, for some time collector of customs there.

VIEW IN THE LAST REMAINING GROVE OF TEXAS PALMETTO

This species is the largest palmetto in the United States. Because of its resistance to teredos, and other good qualities, the wood has been in demand for building wharves, and the species has been almost exterminated, the last remaining grove being preserved by Frank Rabb a few miles from Brownsville, Texas. The hardiness and disease resistance of the species make it of considerable value for planting, and its perpetuation should not be dependent on the public spirit of one man, as at present. (Fig. 9.)

ADZUKI BEANS AND JIMSON WEEDS

Favorable Class Material for Illustrating the Ratios of Mendel's Law—Actual Practice in Making Counts Is Necessary Before the Student Can Fully Grasp Modern Ideas of Heredity

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GENETICS is a difficult subject to teach without an adequate supply of demonstration and laboratory material.

Mendel's law, especially, is in need of illustration. It is like the law of valence in chemistry in that considerable practice in working out ratios is necessary before the student can appreciate and use these laws of definite proportions in predicting results. Counts of actual Mendelian ratios in the field or laboratory are as essential as the manipulation of test tube reagents in chemistry.

Two plants—the Adzuki Bean and the Jimson Weed—have been grown in the genetic section of the botanic garden at the Connecticut Agricultural College and have shown themselves especially favorable material for illustrative purposes in classes in genetics.

The two forms have been used also by several teachers to whom seeds have been sent. Their interest in such material seems to warrant the publication of the present brief paper on the availability of these plants for class purposes.

THE ADZUKI BEAN

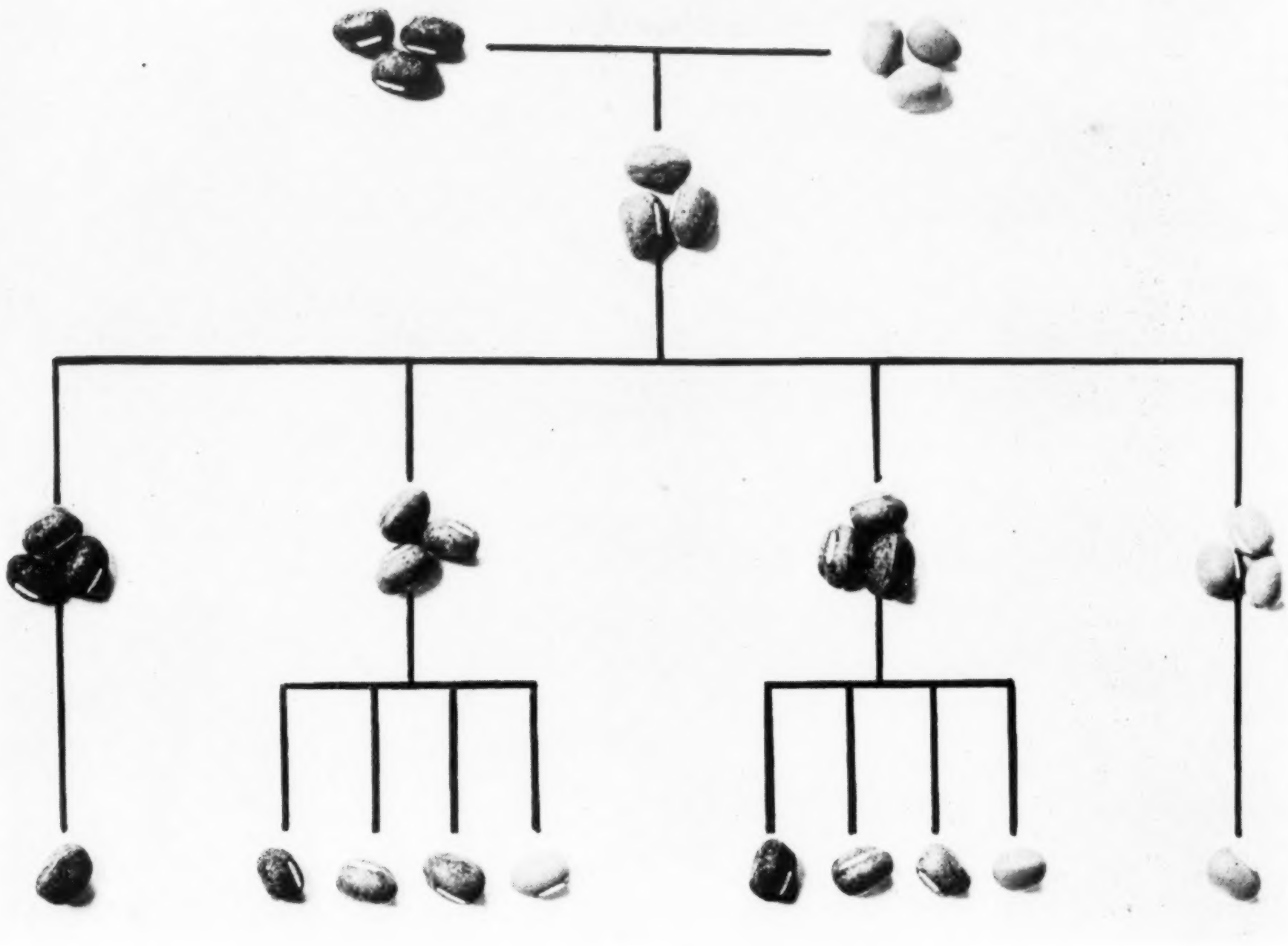
The Adzuki Bean (*Phaseolus Mungo*) is especially desirable as a form with which to introduce the student to Mendel's law.

Pedagogically it is better, we believe, to start with the 1:2:1 ratio rather than with the 3:1 ratio. In the Adzuki Bean, mottling in the seed coat is dominant to lack of mottling. In the hybrid or heterozygous condition, however, the mottling is lighter than in the pure or homozygous condition. Races occur with red seed coats but the difference in mottling shows best on gray seeds. Heterozygous plants, therefore, can be readily distinguished from homozygous plants by an inspection of the seeds which they produce. It should be remembered, however, that the seed coats are maternal characters and do not indicate the genetic composition of the embryos which they enclose.

Fig. 10 shows the expected results from a cross between a plant bearing dark mottled gray seeds and one bearing unmottled gray seeds. The dark mottled and the unmottled gray seeds breed true when selfed while the light mottles break up into a 1:2:1 ratio in each generation. If the intensity of mottling is disregarded this 1:2:1 ratio becomes the more familiar 3:1 ratio. Fig. 11 shows the result that might be expected from crossing a homozygous dominant (dark mottled) with a heterozygous dominant (light mottled) plant. The offspring show all dominant if the presence of mottling is alone considered or a 1:1 ratio if the grades of mottling are distinguished. Similarly in Fig. 12 are shown the expected results from crossing a heterozygous (light mottled) plant with a recessive (gray unmottled).

For class purposes we have never taken the trouble to make crosses since experience shows that off-pollination rarely occurs in these forms.[1] We have grown them thus far three seasons and have found that light mottled seeds always segregate, giving a 1:2:1 ratio

[1] In one instance we found occasional plants appearing with red seeds in a pedigree where only grays were expected. Selfing the plants in this pedigree showed that the white seed coat is dominant to red seed coat and that off-pollination must have occurred in a previous generation.



INHERITANCE OF MOTTLING ON SEED COAT

Seeds of four generations of the Adzuki Bean are arranged above to show how the mottled character of the seed coat is inherited in accordance with Mendel's law. In the original parental generation, at the top, plants bearing dark mottled seeds are crossed with those bearing unmottled seeds. The offspring (F_1) all have light mottled seeds. These F_1 plants, self-pollinated, produce on the average in the F_2 generation one plant with dark mottled seeds, two plants with light mottled seeds and one plant with unmottled seeds. The dark mottled and the unmottled F_2 plants breed true, while the light mottled ones break up in the F_3 generation giving again a 1:2:1 ratio for the mottling of seed coats. Seeds slightly reduced in reproduction. (Fig. 10.)

while the dark mottled and the unmottled forms breed true when selfed. This is so both for forms with red and with gray seeds.

The 1916 records for offspring from light mottled seeds from four different lines are given in Table I below:

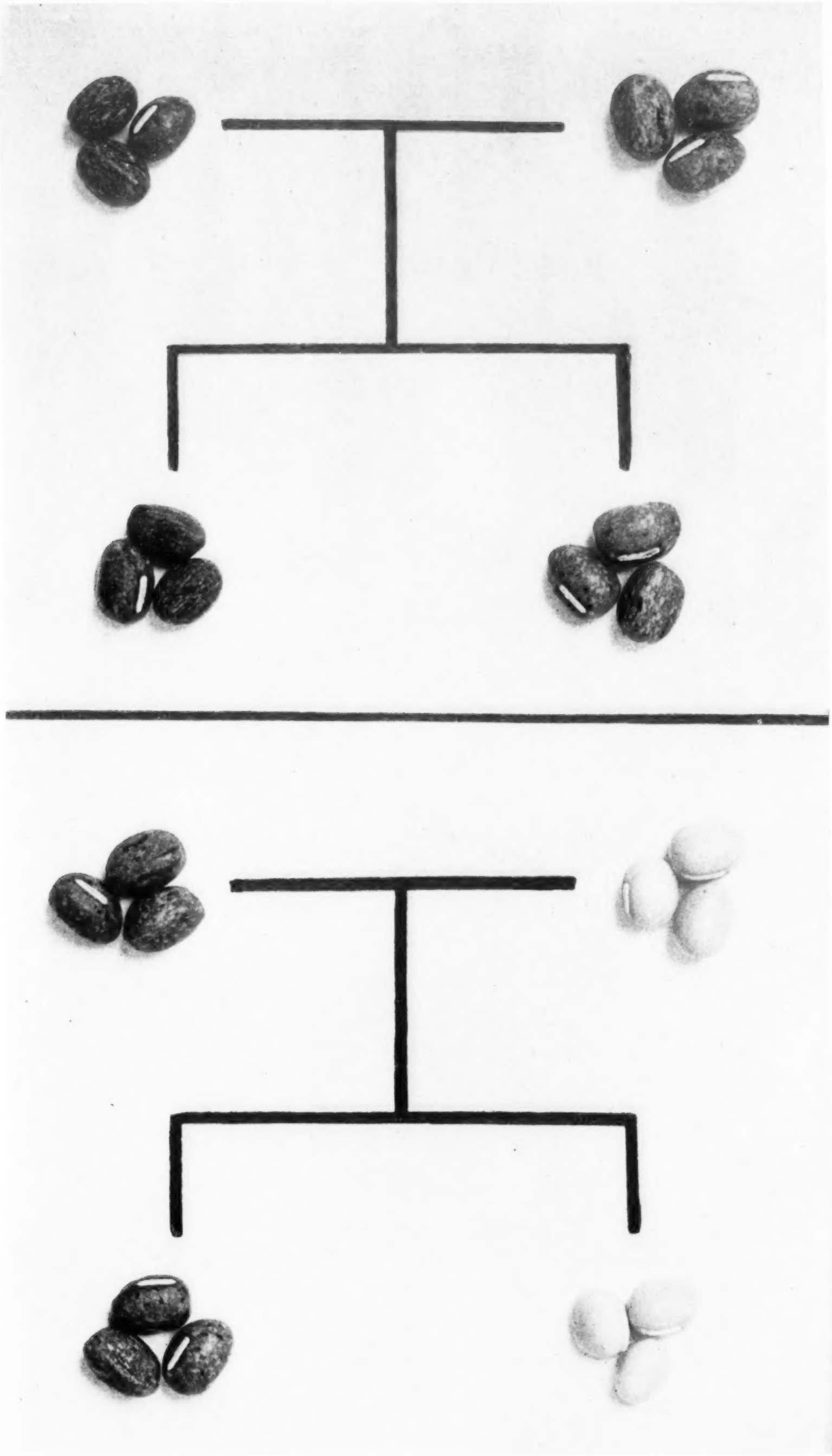
TABLE I

Pedigree number	Dark gray mottled	Light gray mottled	Gray not mottled
A-8.....	60	114	57
A-17.....	5	9	11
A-18.....	44	100	52
A-31.....	21	38	24
Total.....	130	261	144
Expectation...	133.75	267.50	133.75

This gives a total of 391 mottled to 144 grays—a ratio of 2.72:1. Plants that bear mottled seeds—either homozygous or heterzygous—have red pigment in their stems. This is most noticeable in the seedlings and in plants that are ripening their seeds. Seeds may be germinated in the laboratory to show the uniformity of seedlings from homozygous plants, and segregation into a 3:1 ratio from heterozygous plants. Adzuki Beans should be planted out early since they are rather slow in maturing their seed.

THE JIMSON WEED

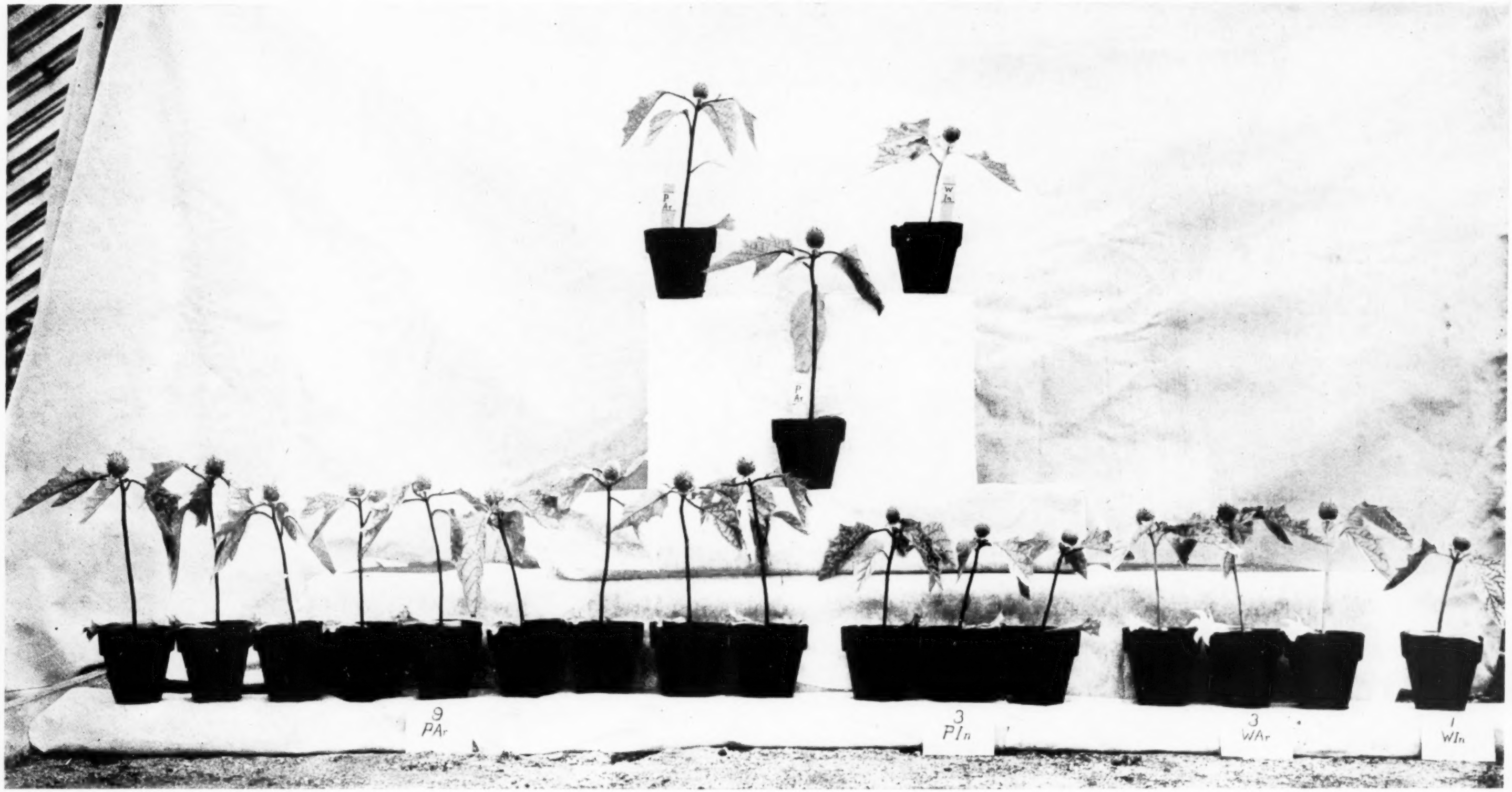
The Jimson Weed is of value from the ease with which it can be handled. It may be grown to maturity in a 3-inch pot or, if given good garden conditions,



TWO CROSSES OF ADZUKI BEANS

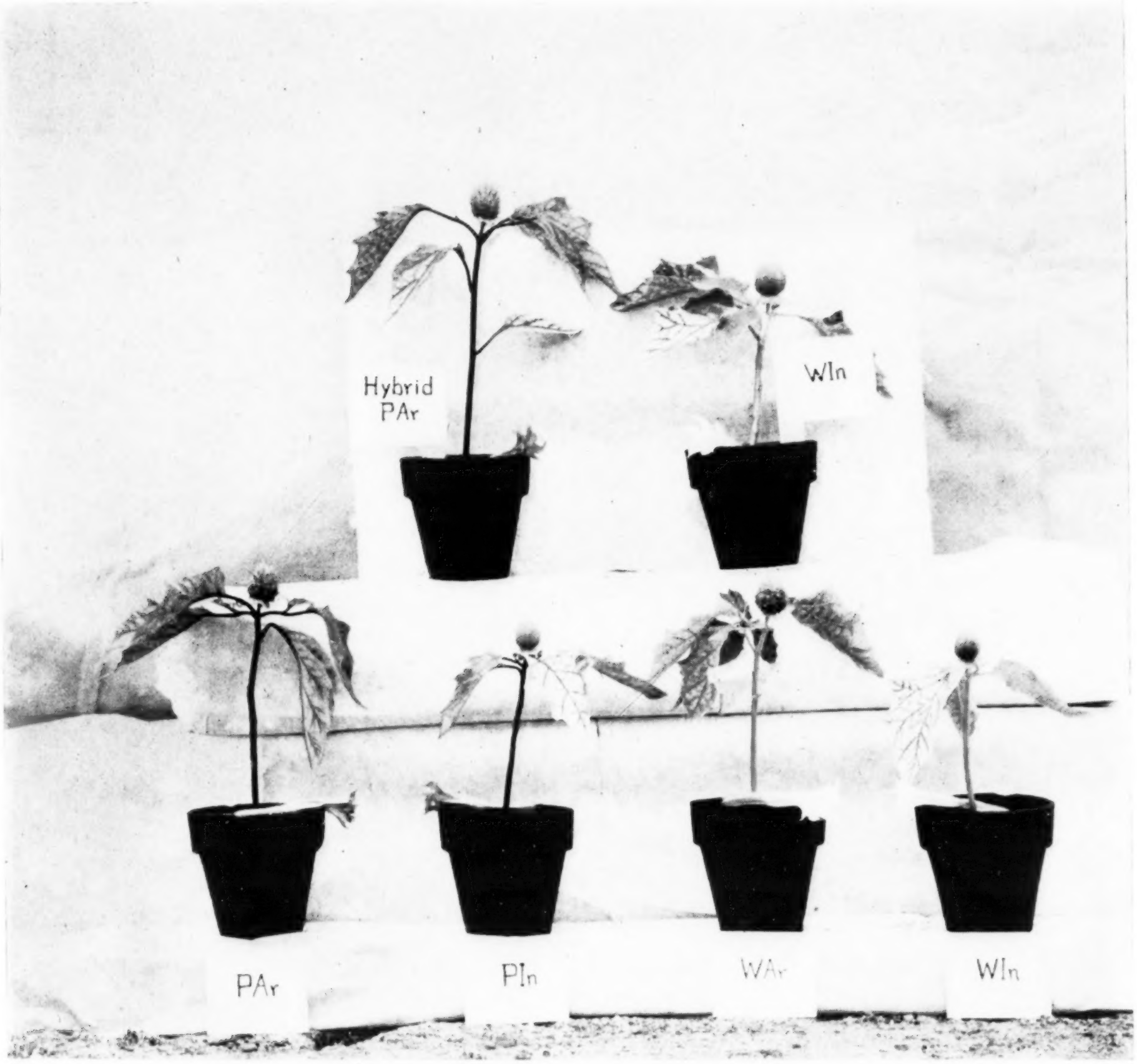
The photographic diagram above shows the result to be expected from crossing a homozygous dominant (dark mottled) plant with a heterozygous (light mottled) one. The parental types of seed-coat are reproduced in the offspring in equal numbers. Seeds slightly magnified in reproduction. (Fig. 11.)

Below is shown the result to be expected from crossing a heterozygous (light mottled) plant with a recessive (unmottled one). Again the parental types appear in the simple and familiar 1:1 ratio. Seeds slightly magnified in reproduction. (Fig. 12.)



A CROSS OF TWO CONTRASTED CHARACTERS

Jimson Weeds arranged to show the average results of a dihybrid cross between a purple-flowered, purple-stemmed plant with armed capsules (PAr) and a white-flowered, green-stemmed plant with *inermis* capsules (WIn). The F_1 plants (of which only one is shown) are all purple armed, while the expected segregation of the F_2 generation shows 9 purple armed, 3 purple *inermis*, 3 white armed and 1 white *inermis*. One of the advantages of the Jimson Weed, for classroom use, is that it can be grown successfully in a 3-inch pot, and a single flower will produce five or six hundred seeds. (Fig. 13.)



THE SIMPLEST RATIO IN A DIHYBRID CROSS

Living diagram showing the result of crossing a heterozygous purple armed Jimson Weed (Hybrid PAr) with a double recessive (WIn). Each of the four possible classes of progeny (described under the preceding figure) is equally represented, giving a 1:1:1:1 ratio. (Fig. 14.)

has been grown to a height of over 6 feet. It is self-fertile and selfed seed may be obtained by merely bagging the unopened flowers. A bud may be castrated just before the stamens open and the stigma pollinated at once from another unopened bud. Thus the time consumed in making crosses is reduced to a minimum. A single cross-pollinated flower, moreover, may produce upwards of 600 seeds. The productivity is enormous. A single vigorous plant may have a diameter of over 6 feet and has been estimated to produce around 50,000 seeds. Students have figured out that if all seeds were sown and grew to plants of the same size and productiveness, it would take only five generations at this rate, including the first plant, to cover the entire surface of the earth, both land and water, and there would be left over sufficient seed to sow several of the planets in addition.

As found growing wild, Jimson Weeds occur in two color forms. Those with green stems and white flowers have been called *Datura Stramonium*, while those with purple stem and purple flowers are called *D. Tatula*. They hybridize readily, however. The color of the stems shows as soon as the plants break ground in the seed pan. The purple color is dominant; selfed seed from plants heterozygous for stem color

therefore should give a 3:1 ratio which can readily be demonstrated in boxes in the laboratory. When grown in the greenhouse, it has been found possible to distinguish heterozygous from homozygous purple plants by differences in the intensity of coloration in the flowers. When grown in the open, however, the differences are not so readily recognized.

There is an unarmed race (var. *inermis*) with smooth capsules. The smoothness of the capsules acts as a recessive to the spiny character in the

TABLE II

(*a*) Dihybrid Crosses—F_2 Offspring. Expected Ratio—9 : 3 : 3 : 1

Parentage		Purple armed	Purple *inermis*	White armed	White *inermis*
Plants heterozygous for both purple and spines, either selfed or intercrossed. Genetic formula—PpAa×PpAa	Recorded	698	228	223	78
	Expected	690.3	230.1	230.1	76.7

(*b*) Dihybrid Crosses—F_1 × Double Recessive. Expected Ratio—1 : 1 : 1 : 1

Parentage		Purple armed	Purple *inermis*	White armed	White *inermis*
Plants heterozygous for both purple and spines, crossed with plants recessive for both of these characters. Genetic formula—PpAa×ppaa	Recorded	89	86	99	88
	Expected	90.5	90.5	90.5	90.5

(*c*) Monohybrid Crosses[2]—F_2 Offspring. Expected Ratio—3 : 1

Parentage		Purple	White	Armed	*Inermis*
Plants heterozygous for purple, either selfed or intercrossed. Genetic formula—Pp×Pp	Recorded	2606	914	.....	.....
	Expected	2640	880	.....	.....
Plants heterozygous for spines, either selfed or intercrossed. Genetic formula—Aa×Aa	Recorded	.....	.....	987	327
	Expected	.....	.....	985.5	328.5

(*d*) Monohybrid Crosses[2]—F_1×Recessive. Expected Ratio—1 : 1

Parentage		Purple	White	Armed	*Inermis*
Plants heterozygous for purple, crossed with plants recessive for that character. Genetic formula—Pp×pp	Recorded	801	811	.....	.....
	Expected	806	806	.....	.....
Plants heterozygous for spines, crossed with plants recessive for that character. Genetic formula—Aa×aa.	Recorded	.....	.....	278	243
	Expected	.....	.....	260.5	260.5

[2] There are included here the records for stem and spine characters abstracted from the dihybrid summaries given in the table above.

commoner armed form (var. *armata*). Capsule peculiarities, of course, cannot be recognized in the seed pan, but the character of the capsule can be discovered early in the bud by dissection.

The color of the stem and the character of the capsule can be conveniently combined to give a dihybrid ratio. A living diagram showing the P_1, F_1 and F_2 in such a dihybrid cross is shown in Fig. 13, while a diagram showing the results of crossing a heterozygous plant with a double recessive is shown in Fig. 14. A report on these characters has no novelty. They were used in Naudin's early hybridization studies and their inheritance has already been investigated by Bateson and Saunders.[3]

A summary, given in Table II, of the data on pigmentation and capsule characters, incidentally obtained in connection with other studies, will indicate the closeness of the ratios to expectation.

A study of variability in the Jimson Weed is being carried on under the direction of the senior author and he would be glad, therefore, to receive material of any striking peculiarities that may be found in this genus.

An excess stock of seed of both Adzuki Beans and Jimson Weeds has been accumulated which may be expected to throw the ratios discussed in this paper. The writers would be glad to send such material to teachers who may request it so long as the material lasts.

More Schemes to Increase Population of Germany

German writers continue to occupy themselves with plans for making good the losses of the war in population. P. Mayet, writing in *Medizinische Reform* (xxii, Nos. 11–13), sets forth a detailed program in six parts:

1. Corresponds to the American Infant Mortality Movement.
2. Special methods for reducing the loss of illegitimate children, among whom the death rate is always high.
3. A comprehensive plan for the physical and intellectual education of youth, to make them more fit for marriage and parenthood.
4. Exclusion of celibates from all public office. It is calculated that this measure would yield an increase of 30,000 births a year.
5. Increase of birth rate by (*a*) fighting venereal diseases and (*b*) giving premiums for each child above three, etc.
6. Insurance schemes to make it financially possible for parents to bring up more children.

However effective such methods might be for increasing the German population, it is hardly necessary to point out that they would, on the whole, produce quantity at the expense of quality.

Study of Egg-Production in Poultry

As a result of five years' breeding of Rhode Island Reds at the Massachusetts Agricultural Experiment Station, H. D. Goodale finds:

First, that the prime factor essential for satisfactory winter egg production from strong stock is early maturity. The records of the station flocks show that, even in the case of birds of one breed hatched from eggs from the same pen supposedly made up of birds of similar breeding, there is an astonishing variability in the age at which the first egg is produced, namely from 195 to 300 days.

Second, the prime factor essential for high annual egg production aside from early maturity is nonbroodiness. A considerable flock of Rhode Island Red hens, none of which was broody during her first year, has been selected and will be used for breeding in the effort to produce a nonbroody strain. Dr. Goodale concludes that if broodiness can be eliminated, the increase in annual egg production may very likely amount to as much as 33⅓%.

[3] W. Bateson and E. R. Saunders, Report to Evolution Committee of the Royal Society, p. 21. 1902.

THE HEN'S ANNUAL VACATION

Scarcity of Eggs in Early Winter Due to Natural Causes—Early Hatching of Pullets Will Result in Egg Production at the Desired Time

GEORGE M. ROMMEL

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IN THE fall of every year, beginning about September 1 and continuing until about New Year, we have what the newspaper reporters picturesquely call a "hen strike." Fresh, new eggs almost disappear from the market stalls. Prices mount upwards with startling agility and never is the appetite for fresh eggs so keen as at this time. To satisfy our appetites we are offered eggs of all sorts, under all kinds of names, but most of them, in the language of the darky waiter, "just won't poach, nohow." Our wives talk learnedly of "no-egg cakes" and how to clear the coffee without an egg shell; editors seize their pens in denunciation of the egg trust, committees of women's clubs are organized to study the situation and the subject even gets a hearing on the floor of Congress.

The reporters' designation carries a grain of truth but really does the hen an injustice. In fairness to her, we should not call this a "strike"; it is a vacation in wholesale, indulged in by every hen of discreet age. It is nature's way of preparing the hens for another season of egg laying and safeguarding the perpetuation of the species.

Egg production, like milk production, is a physiological function, a phase of the reproductive process which man has turned to his own advantage. In a state of nature, the time of egg-laying corresponds rather closely to the passing of winter and the approach of spring. Spring, therefore, and early summer months are the periods of greatest egg supply. When the physiological necessity for a maximum output of eggs ceases to make its call urgent, the hen's egg-laying machinery relaxes and ultimately stops for a well-deserved rest. She changes her feathers (molts) and, with the most serene perversity imaginable, absolutely refuses to lay another egg until she gets ready. Why should she? Fall-hatched chickens would probably not survive the winter and, if they did, would be puny, stunted, and of little value. From this time until the lengthening days signal the return of spring, the hens enjoy their annual vacation. This has always been the way of hens and it always will be. Let us see what can be done to control this habit with the least possible inconvenience to the hens and the greatest benefit to human beings.

HABITS OF THE HEN

A brief consideration of the habits of hens in egg laying shows how seriously this affects the fresh egg supply. Every one knows that a 200-egg hen is a creature of mark and distinction. The famous and late-departed Lady Eglantine is reported to have laid 314 eggs in a single year. If the days that Lady Eglantine did not lay are put in a row, we have a period of fifty-one days during the year when she was idle. A "200-egger" would have 165 days vacation charged to her. Now records like these are extremes—at the top of the list. Probably no flock of any size has ever averaged 200 eggs per year for each female, or even for each pullet in the flock. The average annual production for the whole country is somewhere between 50 and 70 eggs. Average records of 130 to 150 eggs in carefully managed flocks are exceedingly good and are usually confined to the pullets, which always lay better than the mature hens. Even in the best of flocks, with, say, as good an

Date Jan 1916

TRAP NEST RECORD.

Hen No.	Brought Forward	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	Total for Month
✓487			1			1		1		1		N	1		1			1				1			1		N			1		1	11
✓5-00		1		1		1		1			1		1		1		1		1				1		1			1		1		1	14
✓5-03			1		1		1	1		1	1		1		1	1		1			1	1		1	1		1		1				16
✓5-07					1			1			1		1		1		1													1	1	8
✓5-14		1		1	1	1		1	1		1	1		1		1	1		1	1			1	1		1	1		1	1	1	1	21
✓5-15		1		1							1		1		1		1	1		1									N	1		1	10
✓5-16							N	N	1		1	1	N		1			1				1		1		1		1		1			10
✓5-48					1		N		1		1		1				1		1					1		1			1	1		1	12
✓5-49								1		1		1	1	1			1		1				1		1		1		1				11
✓5-50		1		1	1			1	1		1		1		1				1											N	1		10
✓185-6			1	1					1		1	1		1	1			1	N		1				1		1		1		1	1	14
✓1861		1				1			N												1	1		1	1		1	1		1		1	10
✓1862		1		1	1		1	1		1	1		1	1		1			1		1	1			1	1		1		1		1	18
✓1865																															1		1
✓1868		1		1		1		1		1		1	1		1		1		1		1		1		1		1		1	1		1	17
✓1871																									N		N		1	1		1	3
✓1872		1		1				1																									3
✓1873										1		1		1		1		1		1				1		1		1	1		1		11
✓1874			1		1		1																								1		4
✓1875					1		1		1		1		1																					5
✓1877		1	1			1	1		1	1		1	1		1		1	1														1	12
✓1878																																	0
✓1893		1	1		1	1		1																								1	6
✓1894							1				1		1									1		1		1	1		1		1		9
✓1895			1		1		1		1		1		1		1		1		1					1		1		1		1			13
✓1896																				N										1		1	2
✓1897			1	1		1	1		1	1	1		1		1																		9
✓1898		1	1	1	1		1	1		1		1	1		1	1		1			1		1	1		1		1		1	1		19
✓1900			1	1		1	1		1		1	1		1	1		1			1			1		1	1		1		1	1		16
✓1901		1	1	1		1																									1	1	6
Floor		2	2		1				1	1	1	1		1		1	1x	1x	3x										1x			1	

A GOOD EGG YIELD WHEN EGGS ARE MUCH WANTED

Facsimile of the egg report for a pen of pullets during January, 1916. This shows an average daily yield of over ten eggs for the entire pen of thirty pullets—technically over 34 per cent. Three hundred and nineteen eggs were laid during the month. The bottom line "Floor" is the report on eggs laid on the floor which, of course, could not be credited to any particular pullet. *X* signifies broken eggs; *N* signifies that the bird went to the nest but did not lay. Record from experimental farm of the Bureau of Animal Industry. (Fig. 15.)

average output as 150 eggs, there will be an average annual charge of 215 days idleness against the hens and pullets in the flock, a total of over seven months.

Fortunately for us, the hens do not insist on taking all their vacations in a lump. They spread them out, as the trapnest records in Figs. 15 and 16 show. Some hens lay one day and rest the next; others lay three or four days, rest one or two days and then get to work again. All this helps to distribute the egg supply somewhat, and to reduce the total period of inactivity which the molting season inevitably causes.

THE REMEDY

Such being the facts, can the habits of hens be adapted to the requirements of human beings to make the egg supply more steady than it is at present? We get some help from the hens in their

Date Apl 1916

TRAP NEST RECORD.

Hen No.	Brought Forward	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	Total for Month
√487		1	1		1	1		1	1		1	1		1	1		1	1	1		1	1		1	1		1	1	1		1		21
√500		1	1		1	1		1	1		1	1		1	1		1	1		1	1		1	1		1	1		1	1			20
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Floor		1		1			1			1			1										1											

X Broken

MORE EGGS, BUT NO MORE MONEY

Facsimile of the egg report for the same pen during April, 1916. Bird No. 550 was killed by a hawk on the ninth; bird 1878 laid the last egg on the twenty-second; bird 1895 on the eighteenth. These birds were missing at the next weigh-day. April is the month of heaviest production. The birds are vigorously responding to nature's call. The total production for this pen for the month is 583 eggs. Eliminating the three birds mentioned, the production is 547 eggs, an average of over twenty eggs daily, and a percentage of almost 68. Every one's hens are laying now, however, and the total value is no more than in January. *N* signifies that the bird went on the nest but did not lay. *X* signifies that the egg was broken. Eggs laid on the floor are shown on the bottom line. The dots have no significance. Record from experimental farm of the Bureau of Animal Industry. (Fig. 16.)

habit of spreading out the egg-laying period by occasional short rests. To meet the situation, however, we must rely on simple and definite rules of flock management.

HATCH CHICKENS EARLY

The first and most important of these rules is "Hatch Chickens Early." Egg laying begins in young pullets at quite definite periods. In breeds of the American class, such as Plymouth Rocks, Wyandottes, Rhode Island Reds, etc., pullets begin to lay at an average age of 7 months. The Mediterranean breeds (Leghorns, Minorcas, etc.) begin laying a month sooner, when about 6 months old. So, if we want to

GETTING AN EARLY START

The mother hen shines as a brooder, although she may not be broody when needed. A hen can brood more chickens than she can hatch; so hens as brooders may supplement the incubator. The usual number of eggs in a sitting is fifteen; this hen is brooding twenty-one chicks. Photograph from Bureau of Animal Industry. (Fig. 17.)

meet the scarcity caused by the molting of the hens, we should time the hatching so that the pullets begin laying when the hens begin molting. To be on the safe side, the poultry experts advise spreading the hatching over two months so that pullets of different ages are coming on and the eggs are not "all in one basket."

DEVELOP THE PULLETS

The second rule is "Develop the pullets properly." Here we are in rather more danger of overdoing than of underdoing. Of course, pullets to do well as fall and winter layers must be vigorous, thrifty and well developed. The temptation of the amateur is therefore to feed too well and his pullets "begin too strong," start laying with a rush, molt, and begin a heartbreaking imitation of their elders. Considerable skill is required in handling this matter. Rules cannot be laid down which can be followed implicitly. The beginner must learn as much as he can from the experience of others and a study of his own flock, so that the mistakes of one year may be turned to advantage later.

GOOD HOUSING IMPORTANT

The third rule is "Furnish good quarters for the following winter; feed liberally when laying begins." After the pullets have begun to lay the management of the flock has much to do with a steady, continuous supply of eggs. Exposure to cold and storms

FOR EARLY HATCHING, INCUBATORS ARE DESIRABLE

Although an incubator involves some initial expense, it is always ready when wanted. Breeders cannot afford to take any chances of having their chickens hatch too late, and if they depend on hens, the hens may not be inclined to broodiness when they are needed. An incubator is always broody. Photograph from the Bureau of Animal Industry. (Fig. 18.)

will stop egg laying immediately. A hen will not lay an egg in day time when her feet get cold and her comb frozen at night. Trees are bad roosting places if pullets are to lay.

Houses do not need to be expensive; even an old piano box, if tight, makes a good house for a small flock. The houses must be free from drafts, they should have curtain fronts for ventilation and the floors must be dry and well covered with litter. When storms come, keep the birds indoors and feed a little more.

AGAIN—"HATCH EARLY"

All this is of no avail if the dates are wrong. If a pullet is hatched on June 1, she is timed to begin laying not before November 15, no matter of what breed she may be nor how she may be handled, and the chances are she will not begin before January 1. If she is hatched on May 1 and is a Leghorn, well fed and housed, she will probably begin to lay between October 15 and November 1 and will keep up the good work all winter long. By careful timing of hatching so that pullets come at intervals from March 1 to April 30, the problem of a winter egg supply is on a fair way to solution.

Before proceeding further in the discussion, certain correlated benefits from early hatching should be pointed out. The poultry raiser who hatches his chickens early has the advantage in every respect over his neighbor who lets nature take her course; not only do his pullets make good as winter layers, but the young males can be sold as broilers when the broiler market is at its best. Furthermore, the early hatched bird makes better growth, is more thrifty and is more resistant to disease than the late-hatched one. If the poultryman raises standard-bred fowls, his best advertising will come from exhibiting at the poultry shows. Here growthiness, vigor and size for age are essential. These features, of course, are almost out of the question

A WELL-EQUIPPED POULTRY PLANT OWNED BY THE U. S. DEPARTMENT OF AGRICULTURE

The above photograph shows young birds on range at the Government Poultry Farm, Beltsville, Md. The chickens are of various ages. The large structures at the left are brooder houses. The small structures in the center with half-pitch gable roofs are self-feeders, where the chickens may eat when hungry. The remaining structures are ordinary colony houses for growing birds. All are portable. Pullets go from this range direct to the laying houses. Photograph from the Bureau of Animal Industry. (Fig. 19.)

GOOD SPECIMENS OF A FAVORITE BREED

A flock of spring-hatched Barred Plymouth Rock pullets on the Bureau of Animal Industry's Experimental Farm at Beltsville, Md. The photograph was taken in the fall just as they were beginning to lay. (Fig. 20.)

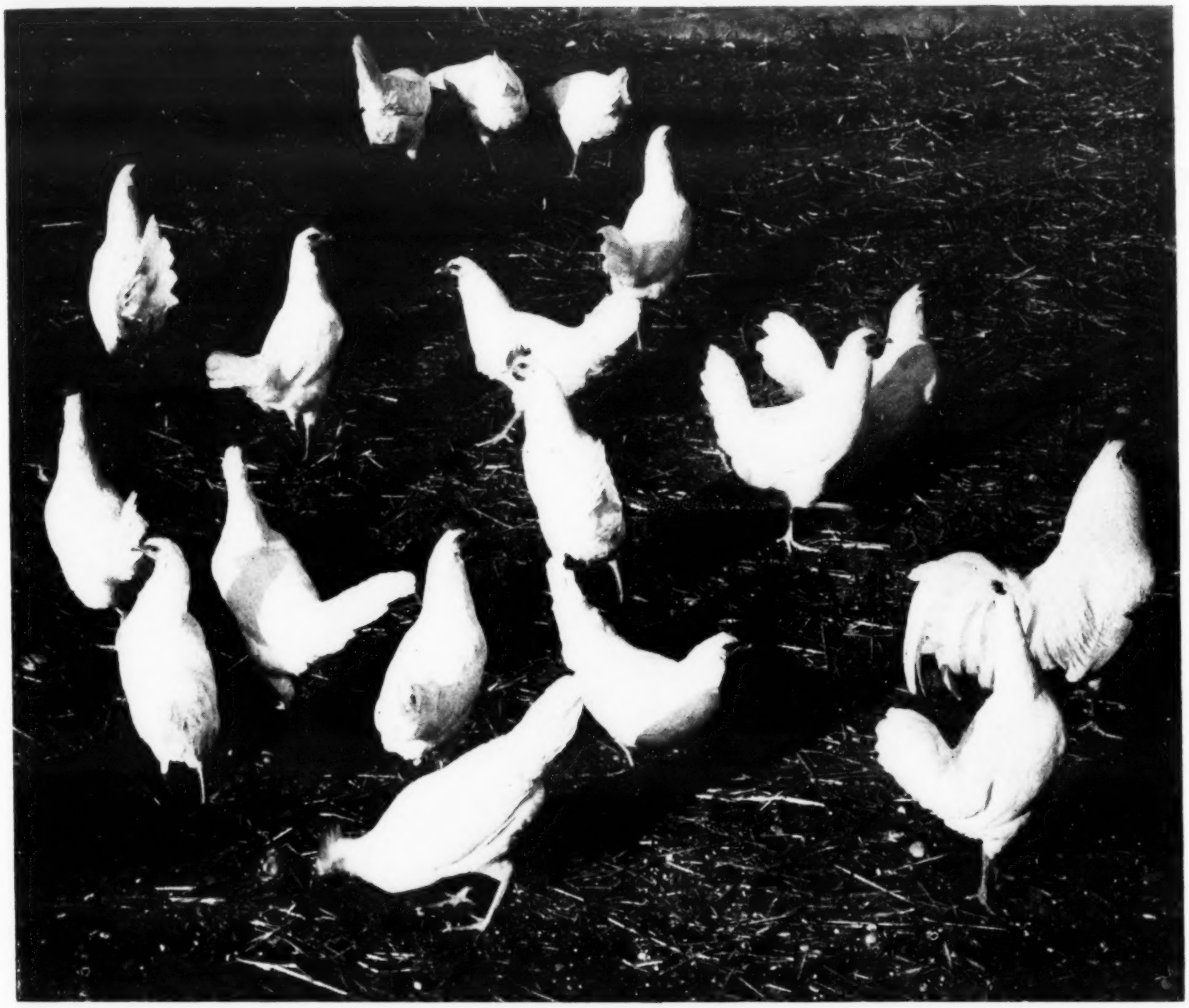
in late hatched stock. From every standpoint, therefore, early hatching is profitable to the poultry raiser.

DIFFICULTIES IN THE WAY

So far as the question of early hatching is concerned, the principal problem is to get the eggs properly and promptly incubated. If the poultry raiser has an incubator, he will be able to hatch when he pleases. If he depends on hens, and has never hatched early, he must get broody hens elsewhere. Like egg-laying, broodiness in hens is part of a cycle. Right now, for example (February 14), the hens are not broody because they are not through laying, and they are not through laying because they did not begin laying early; they did not begin laying early because they were hatched too late. Once we get the magic circle broken and change the dates on the hens, we will have plenty of broody hens when we need them. The only exceptions will be with the Mediterranean breeds, the hens of which do not have so great a tendency to become broody as those of the American breeds.

IS SUCCESS POSSIBLE?

Poultrymen who have tried it, agricultural colleges, and the U. S. Department of Agriculture, are confident that a concerted, systematic effort on the part of poultry raisers would help to prevent the annual fall and early winter scarcity of fresh eggs.



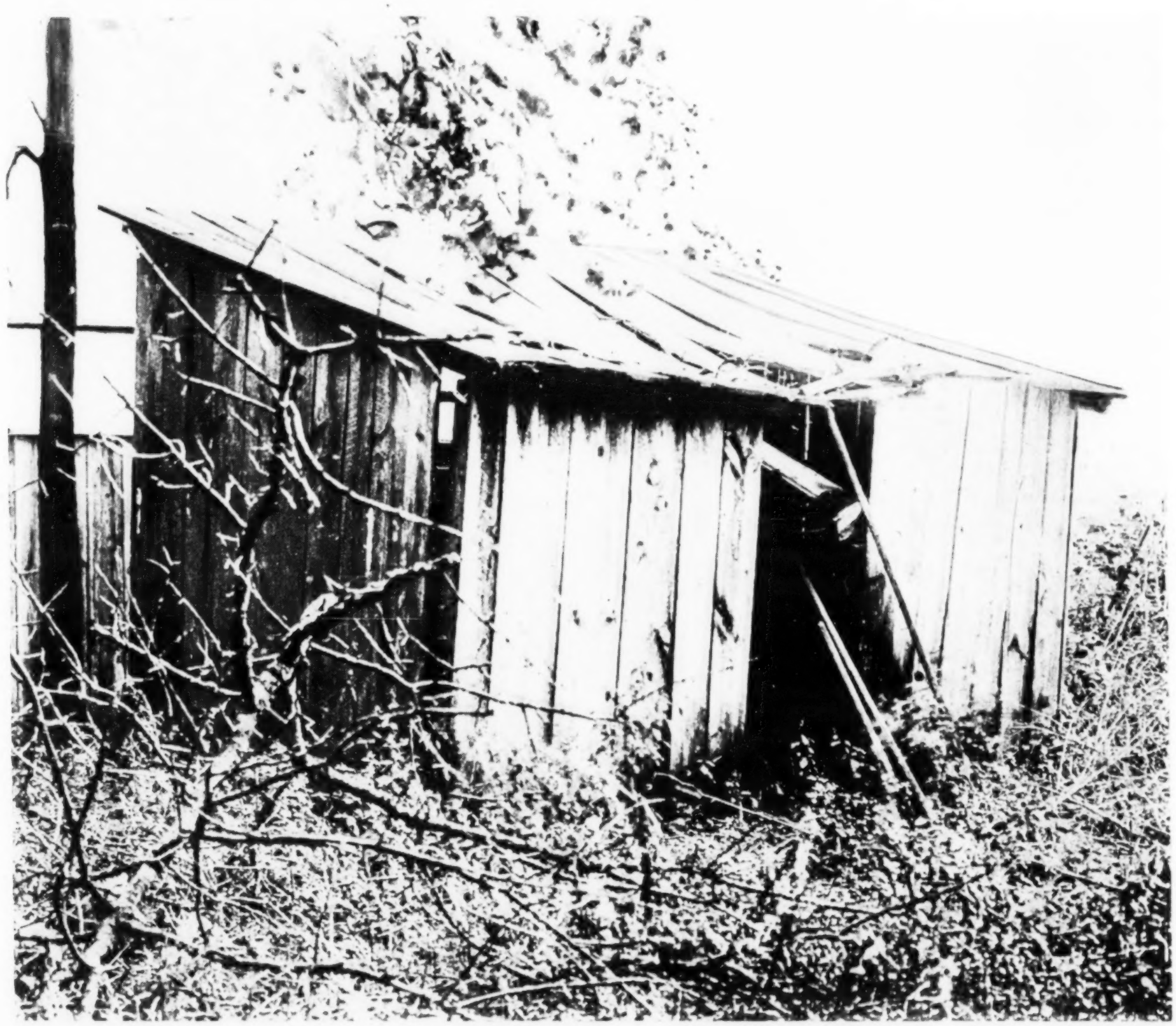
A POPULAR BREED OF EGG-PRODUCERS

No fowl is more widely known and liked for egg-laying than the Single Comb White Leghorn, but it will not be as valuable to its owner as it should be, unless it is hatched early. The above photograph of part of the Bureau of Animal Industry's flock at Beltsville, Md., shows the appearance of the pullets in their first fall, when they were beginning to lay, at a period when eggs were scarce and high in price. (Fig. 21.)

The records of any well-managed flock demonstrate this fact. For example, in the flock of the Bureau of Animal Industry, 220 pullets averaged 27½% daily egg production during November, December and January last. That is to say, the egg production of these pullets was better than one egg every day for every four hens. These pullets averaged 16% in November, 25% in December and 40% in January. The best pen of thirty birds averaged 30% in November (nine eggs daily), 35% in December (better than ten eggs daily) and 30% for January. One other pen of thirty birds made a record of 50% in January, but had not laid so well in the preceding months. These were the best and earliest pullets in the Government flock, but the yield for the entire flock of 650 pullets was better than 20% (one egg daily for every five pullets). Now the important part of this to the poultry raiser (and to the consumer as well), is that this production was being accomplished when fresh, new-laid eggs were selling at unheard-of prices in Washington. For weeks during this period fresh eggs brought over 50 cents per dozen and at one time they sold for 75 cents per dozen. The same was true in other cities. Such a market should attract the producer because these prices yield a very good profit. Of course, if a large number of poultrymen went into

AT THE END OF A PRODUCTIVE SEASON

A Rhode Island Red hen beginning to molt. She is at the end of her "pullet year," in which she laid 142 eggs, fully twice the average for all hens in the United States. Her feed consumption in this time is shown in the photograph, which was made by the Bureau of Animal Industry on its farm at Beltsville, Md. (Fig. 22.)



NO INDUCEMENT TO EGG LAYING

A pullet will not lay when her feet are cold and her comb is frozen. This is a fair example of much of the housing provided for poultry in the United States. Photograph from the Bureau of Animal Industry. (Fig. 23.)

CHEAP BUT SATISFACTORY HOUSING

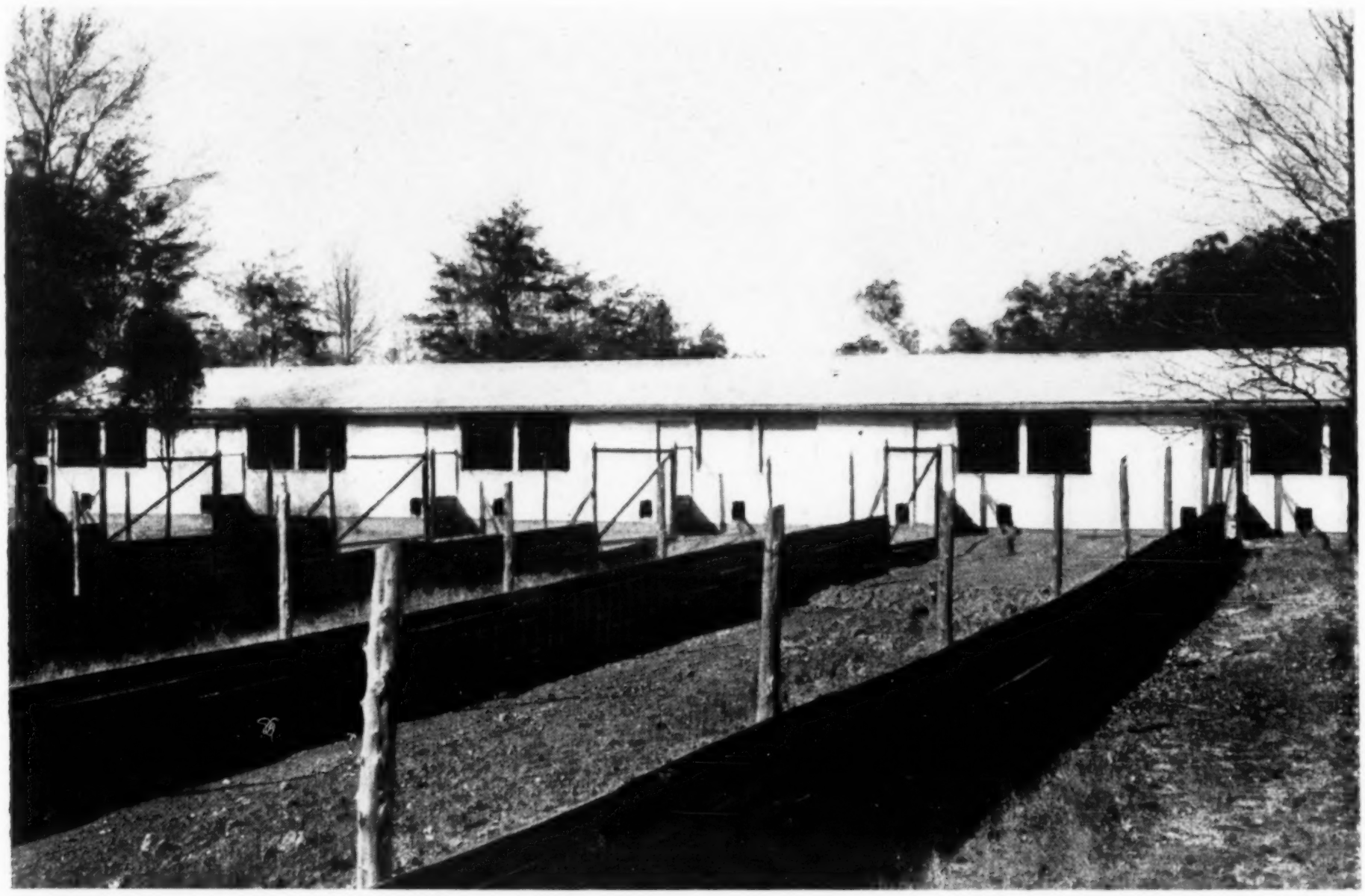
A poultry house need not be expensive to be efficient. An enterprising grower in a Washington suburb uses piano boxes with excellent results. Photograph from the Bureau of Animal Industry. (Fig. 24.)

fall egg production the price would be lower, in which case the consumer would benefit.

PUBLICITY CAMPAIGN UNDER WAY

Public agencies are now engaged in a propaganda to induce poultry keepers to increase the supply of fall and winter layers. Kansas, a State in which the poultry industry has great commercial importance, has already taken what is believed to be the first official step of this kind. The Agricultural College is behind the movement. The Federal Department of Agriculture is now going into the matter. Articles are being furnished the press and circulars distributed to the public showing the advantages of fall egg-laying. The problem is a national one, intimately affecting the food supply; therefore the Federal Government's interest. It is of the greatest importance to city dwellers everywhere who are largely dependent on nearby sources of supply for fresh eggs; hence the interest of the State governments.

The Federal Department of Agriculture takes a great deal of satisfaction in the outcome of its infertile egg campaign. This has been accomplished largely by printers' ink and pictures, and has established quite generally the practice of producing only infertile eggs in summer. The support of the trade, transportation companies, warehousemen, the agricultural colleges and state officials has made that campaign such a success that the superior keeping qualities of the infertile summer egg are now a matter of common knowledge and the production of infertile eggs in summer is a common practice. The keynote of the success was a simple rule of poultry management. By observing this rule, anyone can produce infertile eggs. The production of fall and winter laying pullets is based on a rule which is equally simple, although it requires more attention to details of management for its successful application. The two are very closely correlated. To produce infertile summer eggs, remove all male birds on May 1.



WHERE THE GOVERNMENT'S HENS LIVE

The main laying house at the Government poultry farm. The curtains are down in one compartment. The only purpose served by glass is to admit sunlight. The curtain acts as a ventilator. If the hen-house has a curtain in front of the roosts, fowls will be comfortable in the coldest weather provided the house is properly constructed otherwise. Photograph from the Bureau of Animal Industry. (Fig. 25.)

To produce winter laying pullets, hatch all chickens not later than May 1. Poultry keepers should keep this date firmly in mind, and let the year of their flock operations revolve around it. For southern localities, earlier dates should be selected, until we reach the Gulf States, when hatching may begin as early as December.

Every part of the country suffers from the effect of the hen's annual vacation. The time of its occurrence varies with the latitudes, but its regularity of appearance in a given section is as certain as seedtime and harvest. If we must have really fresh eggs during the entire year, we must furnish pullets to serve as substitutes for the molting hens and distribute the egg yield as evenly as possible throughout the year.

To summarize the foregoing remarks, these are the three simple rules for fall and winter egg production:

1. Hatch chickens early—between March 1 and April 30.
2. Develop the pullets properly.
3. Furnish good quarters for the following winter; feed liberally when laying begins.

A Valuable Collection of Reprints

W. J. Spillman, of the U. S. Department of Agriculture, has presented to the JOURNAL OF HEREDITY a collection of several hundred reprints, covering most of the progress of genetics from the rediscovery of Mendel's law to 1912. The gift is most welcome because the collection of reprints already in the office of the Association dates from 1913. The editor takes this occasion to remind workers in the field of genetics that reprints of their publications are always received with pleasure, and made part of the permanent library.

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